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[OFFICIAL NOTICE.]

New England Association of Gas Engineers.

BIRMINGHAM, CONN., Feb. 9, 1889.

The annual meeting of the New England Association of Gas Engineers will be held at Youngs' Hotel, Boston, on Wednesday and Thursday, February 20 and 21, 1889. The meeting will be called to order on Wednesday, at 10 o'clock A.M., by the President, Hon. A. M. Norton.

At one of the meetings a lecture will be delivered on the "Composition of Boston Gas," by Dr. Lewis M. Norton, of the Massachusetts Institute of Technology. From Dr. Norton's known position as a scientist, and his ability as a speaker, it can be assumed without question that the Association will listen to an interesting lecture.

The following papers have been promised:

"Experiences with a Springer Cupola," by H. S. Chase.

"Incidents in the Life of a Superintendent of a Small Gas Works," by A. F. Cooper.

"Use of Lima Oil for Enriching Gas," by J. L. Hallett.

"Elements of Gas Analysis," by E. C. Jones.

"Artistic Articles used in Connection with Artificial Lighting," by R. J. Monks.

"Photometric Standards" (Report of Committee), by C. F. Prichard.

"Breaking Coke," by F. C. Sherman.

"Gas and Electricity," by S. G. Stiness.

I think that the members will agree with me that the above list of papers will make the literary part of our meeting a great success. No member of the Association and no man actively connected with the gas business in New England can afford to be absent, if it is possible for him to be present.

Persons eligible for membership, either as active or associate members, and wishing to join the Association, will please send their names to the Secretary at once, who will immediately forward them blank forms of application.

Any person applying for membership will be welcomed at the meeting of the Association the same as if a member, and any person interested in the gas business, not a member of the Association, and wishing to attend the meeting, will please notify the Secretary.

Any member of the Association wishing to have any particular subject discussed will please notify the Secretary, who will in turn notify the members of the Association of the same, so as to enable all to come prepared to discuss the subjects more intelligently than otherwise would be possible.

If the members who have not paid their dues for '89 will remit to the Secretary before the meeting, it will give the latter more time to devote to the other and more important interests of the Association.

As this circular will be sent to all the gas companies in New England, I desire to say a word on the importance of every gas company in that territory being represented in our Association. Quite a number are not so represented, and to such companies I would say that it is the experience of every gas manager who attends our meetings that sufficient information is obtained to repay the company with which he is connected many times the amount of his expenses. Besides the manager of every

gas company, no matter how small or large, needs to be brought in contact with men in his own line of business, otherwise he is sure to fall into ruts—to do things in a certain way because he has always done them so.

In this day of strong competition, stronger than we have ever had before, that way does not lead to success. It is absolutely necessary, if a company is to succeed, that it be kept abreast of the times; and it is believed by our ablest managers that the meetings of our gas associations are the best means to accomplish this result.

A few, very few, companies will not pay the expenses of their representatives when attending these meetings, and as a result some of our members are obliged to stay away. I am confident that such companies lose ten dollars and more where they save one.

The largest outlay necessary for any company in New England to send their manager to Boston would probably not exceed $30, and if, as a result of that expenditure, a saving can be made of one bushel of coke per ton of coal carbonized, or tar be sold for 25 cents more per barrel, or the yield per retort or per man be increased 500 or 1,000 feet per day, or the yield per pound of coal be increased one-tenth of a foot, or the leakage be reduced one per cent.; if any of these results can be reached the expenses will be returned, except in the case of the very smallest companies, several times in each succeeding year; and where, as in many cases known to the writer, the gain is in all the points stated above, the return is enormous in proportion to the outlay.

As the companies receive the benefit of the information gathered at these meetings by their representatives, is it fair that they should expect the expenses to be paid out of the salaries, which, in most cases, are none too large, of their managers or superintendents or treasurers?

I hope that this practice will cease and the expenses be assumed, as they should be, by the companies. Respectfully,

CHARLES H. NETTLETON, Secy.

BRIEFLY TOLD.

THE LAST GUN.—In further comment of Secretary Nettleton's neat way of doing business we have only to call attention to his current (and last) circular in respect to the meeting at Boston this week. His latest schedule of authorship we note includes the name of another veteran, who, as is his wont, elects to discuss a practical subject; and it may be taken for granted that what the New Haven manager has to say on the matter of "Breaking Coke" will be well worth listening to. For certainly Mr. Sherman has the knack in a remarkable degree of speaking to the point, wherefore we are led to hope that the members will not spare to ply him with questions in order that the discussion shall assume and be of a sifting nature. The real meat, however, in the Nettleton circular is attached to his pointed, pithy and proper remarks concerning the advantages to be gained by the proprietors of the gas companies themselves in having a representative at the sessions of the Association: and in seeing to it that these representatives are supplied from the treasuries of the companies with the funds necessary to their transportation and comfort while away from their respective homes, on the *business* pure and simple of *their employers*. There is no blinking the fact that some gas directors are very much alive to the value of each penny that enters into the composition of a dime; and while it is certain that dimes, if saved, will accumulate to the dollar point, it is nevertheless true that dimes and dollars, when allotted to the security afforded by a tightly sealed teapot, ever remain of the same value--unless ounce-silver either raises or lowers in the market rate. And it seems to us that the director who thinks he is wise in "saving"—*i. e.*, not paying—the expenses of a representative to the Association meetings is simply investing in a bank of the teapot order. It gives us great satisfaction to read such plain language as that put forth by Mr. Nettleton in sustaining his views on the benefits of representation in gas associations, and have only to point to our admonitions of former years to show where we stood and how we stand in relation to this platform. We say to the Directors, do not send your representatives there with the idea that you are paying for a mere frolic for them, but do so in the firm knowledge that, instead of a teapot investment, you are to receive in the shape of interest $20 for each dollar expended. This is the plain truth, without a single draw-back; and as even the teapot investor prefers $20 to $1—his penchant for the greater being just 19 times stronger than for the lesser sum—perhaps Mr. Nettleton's argument will bear its quota of fruit.

THE quiet and retired gentleman who from his eyry in Beaver street, perched high above the roar of the commerce of the Exchanges, is calmly directing the internal machinery of a venerable blanket known to the trade as the *Journal of Commerce*, is said to have two distinguishing characteristics, neither of which may be said to be of a bad order. The first is a yearning passion and doting fondness for flowers; wherefore when the editor is not editing he is usually gardening in the solitude of his farm on Franklin avenue, in the city across the river. Solitude, did we say? We fear that is a mistaken view to take of his broad acres; for his second characteristic is said to assume the nature of an intense fear of designing women, who would or no detach the editor from his single condition. And where can be found solitude, the ramparts of which are invadable to the feminine designer? It is said that when the editor's Franklin avenue citadel has been stormed by the designing that the routed hies to his New York establishment, there to dissipate his fear by formulating editorial attacks on some person or thing. If this is so, editor Stone must have been badly stirred about the third week in January last, for his relief valve, or courage restorer (the *Journal of Commerce*) of January 21st contains a "thundering leader" on the ravenings of the gas companies. But we fear that the "thunderings" are only evidences of his perturbation, the argument simply leading up—to what? Well; the long and short of it is in the remedy proposed. Our cities must take, according to Stone, charge of the manufacture and distribution of gas; cause this to be a governmetnal function, and so on. Now does it not look as if the Stone were merely using this argument as a step toward securing the committal of all designing females to the custody of the State; for the latter would seem to have as good a right to perform the one duty as to assume the other. Mr. Stone, however, outlines certain processes in gas manufacture which municipalities might take advantage of in their conduct of gas enterprises, not the least notable of which is contained in an explanation to the effect, "That one cannot readily conceive how its '[water gas]' production could be further simplified, since the whole operation consists in passing steam over incandescent coke in red-hot iron tubes. The hydrogen of the vapor is more or less perfectly isolated in the process, and then undergoes purification before use as light." No, Mr. Editor, one could much more readily conceive how violently one can flounder when he gets beyond his depth—if he cannot swim, that is. He, however, goes on from bad to worse, and, having said that gas (presumably the New York city article) costs the makers "not to exceed 30 cents," he seems not to know that he is writing himself down the reverse of a Solon. The editor explains this on the ground that the main ingredient of the gas is water. Seriously, what hope is there for expecting that the public shall know anything about gas, in a truthful sense, when the framer of their daily literary pap puts forward such bosh as the writ of applied science? None, or but slight, at best. Let us hope that after his next experience with the wily woman, Editor Stone may not be moved, in the attempt to whistle up his courage to its normal condition, to tell his long-suffering patrons of the *Journal* about the "hydrogen vapors" and watery ingredients of illuminating gas.

ON Saturday, Feb. 9th, at the invitation of the Philadelphia Gas Improvement Company, added to a like admonition from the authorities in charge of the Philadelphia Gas Works, a goodly company assembled at the 25th Ward station of the plant to inspect the water gas apparatus and equipment recently put in operation there. Candor compels us to say that the contractors have every reason to "point with pride" to the promptness with which they fulfilled their promises, and to the completeness and stability of the work performed. The ceremony of inspection was promptly, though not perfunctorily proceeded with, and terminated in an excellent collation served in the upper section of the huge meter house. During and after the repast many witty things were said, in which bloodless contest the honors were easily taken by ex-Attorney-General Wayne MacVeagh. Among the notables present were Mayor Fitler, City Solicitor Warwick, City Treasurer Jno. Bardsley, Prothonotary W. B. Mann, Col. A. K. McClure, Director Wagner and Chief Park. To name the gas men present (including, of course, the ubiquitous contractor) would seem like reprinting the latest directory of gas companies and our advertisers' index as well. About 500 guests were present, and the arrangements in every sense were excellent.

DEATH OF MR. JNO. CARTWRIGHT.—We regret to have to announce the death of Mr. Jno. Cartwright, whose demise occurred at Poughkeepsie, N. Y., on the 19th December, 1888. Appoplexy was the cause. Deceased was a member of the Cartwright family, so well and favorably known to the fraternity of the East. For many years he filled the position of Superintendent of the Poughkeepsie (N. Y.) Company.

AT the annual meeting of the Salem (Mass.) Gas Company the following officers were chosen: Directors, W. M. Jelly, S. O. Dalrymple, H. T. Conant, G. W. Pease and W. H. Kendall; Treasurer, D. Moore; Clerk, B. W. Sleeman.

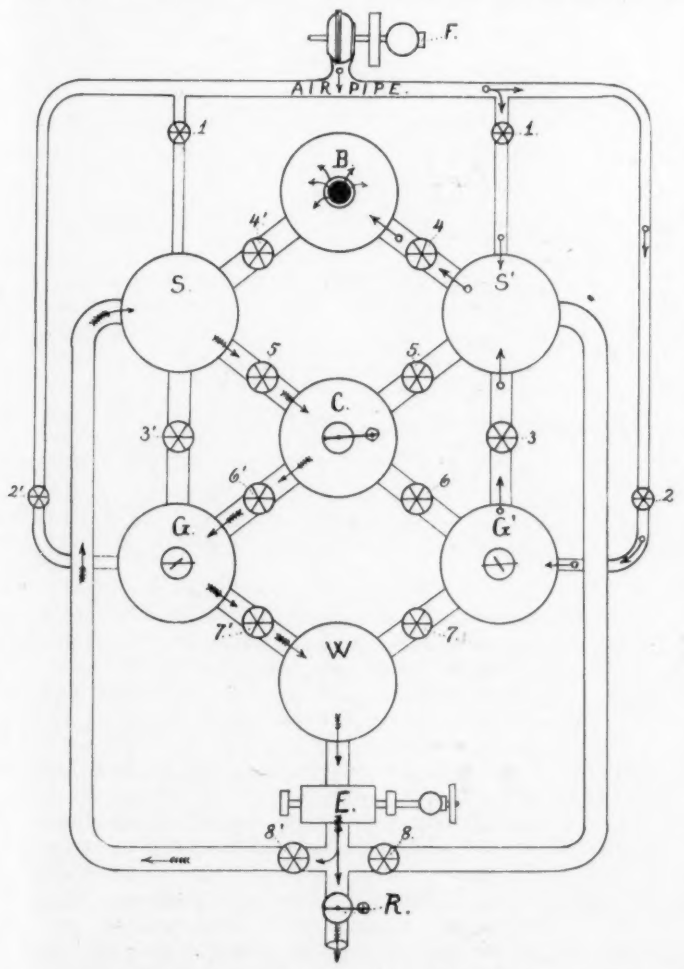
A Proposed New Departure in Gas Making, as Shown in the Westman Process.

By FREDERIC EGNER.

On page 3, current volume, was mentioned the invention of Mr. Gustaf M. Westman, which consists in what seems to be a really new process and apparatus for the manufacture of gas from bituminous coal. As the inventor not only claims remarkable results, but in addition to his claims gives some good reasons why he believes that he can accomplish all he states with his apparatus, the following extended description of the process is given.

First, as to what Mr. Westman believes he can do. He thinks he can obtain about twice as much gas from coal than is possible by the retort process, and that by means of his apparatus only 10 per cent. of the labor now necessary will be all that is required. But that is not all; for the first cost of the apparatus is to be much less; space needed for equal capacity very much less, and cost of repairs of apparatus a trifle as compared with the present system.

The patent is dated Nov. 20, 1888 (No. 393,194), and shows a neat, practicable apparatus; but, as it would not be easy from the drawings and specifications to obtain a clear idea of the process without considerable study, the accompanying diagram has, therefore, been made to assist the reader in following the steps taken in operating and making gas by the Westman method. In the diagram *B* is a steam boiler; *SS'* are



checker-brick superheaters, such as are used in water gas manufacture, with only slight but important changes in the internal arrangements; *C* is a vessel built very much like a water gas generator—it is to be filled with gas coal, ranging from fresh coal at the top, to coke at the bottom of the vessel; *GG'* are coke chambers, constructed like the generators in common use in many kinds of water gas apparatus; *F* is a fan or any kind of a blower, with engine; *W* is a condenser or cooler; *E* is an exhauster, with engine; *R* is a weighted valve, which we will call the relief valve, and 1, 2, 3, etc., etc., are valves.

The feathered arrows show the direction of the gas made from the coal, while gas making is going on in one portion, and the ball arrows show the direction of the air used, fuel gas produced, and course of products of combustion while heating up the other portion of the apparatus when the whole is in operation. It should be remarked here that the valves shown in the patent drawings are of a special design, and will reduce the number of valves as per diagram about one-half. The steps in operating this apparatus, both in heating up and making gas, would be as follews:

Let us suppose that steam is up in the boiler *B*, that generators *GG'* are filled with hot coke; that superheaters *SS'* are heated to a suitable degree, and the coal chamber *C* contains a charge of coal, ranging from fully carbonized to fresh coal, and that the space remaining in the vessels and pipes is filled with gas. Let us now suppose we are going to make gas in the left-hand side of the apparatus and heating up the other side. In that case valves 1', 2', 3', 4', 5, 6, 7 and 8 must be closed, and valves 1, 2, 3, 4, 5', 6', 7' and 8' opened. Air is forced into and through the coke in generator *G'*; the resultant fuel gas passes into the bottom of superheater *S'*, when it is burned by means of the secondary air supply from pipe 1. The checker-brick are highly heated by these well-known means, and the products of combustion pass on, to and through the flues of the boiler, and then out of the chimney. While this is going on the exhauster *E* draws gas from the cooler, *W*, and forces it through the superheater *S*, which, for convenience sake, we have supposed to be ready for work. The intensely heated gas then passes in at the bottom of the coal chamber *C*, through the coal, and out at the top, then enters the bottom of the chamber *G*, filled with incandescent coke. In its passage through the coal the hot gas will extract and drive off the gas contained therein in the shape of gas, tar vapors and steam; and then will become further transposed, deposited or fixed, according to the nature of the various gases obtained in passing through the before-mentioned coke chamber. From the latter the gas passes to the cooler *W*, where any condensable vapors are deposited. Then the gas passes again to the exhauster.

In the described circulation of gas we would, of course, have increased the volume of what we had at the beginning, and all that is not required to completely fill the apparatus would pass off through the weighted relief valve *R*, and thence on to the condensers, purifiers and holders.

The writer is aware of the questions and doubts likely to arise in the minds of gas men concerning the practicability of some of the steps in the process described. There are some accepted theories in the way of at once falling in unhesitatingly with Mr. Westman's new departure in coal gas making; but the object of this article is not to plead for nor speak against the process; rather to present what seemed to the writer to be a very interesting study in proposed gas making.

We will now give the inventor's explanation as to what he believes he can do, and why he thinks so, in his own words. A subject so full of promise, and coming from an able engineer and scholar, deserves at least serious consideration. Mr. Westman's statement is as follows:

"My method produces the illuminating gases, each as they now are, with very slight chemical difference, by compelling the coal to give away its latent gases by means of introduced heat. As the heating of the coal must be done without the access of air, it has hitherto been necessary to use retorts in order to arrive at the desired result."

He then proceeds to give a short account of the results of our well-known coal gas process, which serves to show that he has a clear understanding of the same, and then goes on:

"My system consists in filling a shaft furnace with coal and cause a part of the previously-produced gases to carry to the coal the necessary heat from a highly-heated regenerator. After having passed the shaft furnace with coal, this gas, together with that newly made from the coal, is passed into another shaft containing glowing coke. In that manner the greater part of the steam (from the water in the coal) will be transformed into water gas and carbonic oxide; the hydrogen will partly go over to light hydrocarbons. The tar gases will also be separated into heavy hydrocarbons and a tar higher in carbon. To these, for illuminating gases highly useful reactions, may be added as further advantages of my system the following: 1st, that no gas will be left in the residuary coke; 2d, that the fuel required will be reduced to one-third; 3d, that no external air can enter the apparatus, as it is worked under inside presure, and all parts are surrounded by air-tight casings of boiler plate; 4th, that the carbonic acid which is found in gas making is carbureted in passing through the glowing coke (and hence from a useless, turned to a useful compound); 5th, that the labor required in my process is reduced to about 10 per cent. of the labor required in the old methods; 6th, that I receive nearly double the quantity of gas from the same quantity of coal.

"Although the above should be sufficient to determine the value of my process, and an inducement to get it practically demonstrated, when exact figures on the quantity of gas, and its chemical composition as well, could be arrived at, I will try in advance to calculate these two factors on account of the chemical operations arrived at in my

method. The new-made gases, besides ammoniacal liquors and sulphureted hydrogen, will consist of hydrogen (H), light hydrocarbons (CH_4), heavy nydrocarbons (C_2H_4), carbonic oxide (CO), carbonic acid (CO_2), and steam (H_2O). When these gases are passed through glowing coke the carbonic acid and steam are converted into carbonic oxide and hydrogen, after which the final quantity of carbonic oxide depends upon and can be calculated from the oxygen originally contained in the coal. To determine in advance how much heavy hydrocarbons will arise from a given quantity of tar, and how much of the hydrogen will be carbureted when passed through glowing coke is more difficult, for the reason that this reaction depends upon the temperature, which, in this case, constantly varies; but we can show these results approximately after all parts of the new-made gases are given. Analyses of illuminating gas have, on an average, given the following results. One cubic meter of gas contains about:

0.40	cubic meter	H,	with a heat value of			3,070 =	1,228	calories.
0.40	"	"	CH_4	"	"	"	9,500 = 3,800	"
0.08	"	"	CO	"	"	"	3,000 = 240	"
0.045	"	"	C_2H_4	"	"	"	15,000 = 675	"
0.025	"	"	CO_2	.....	.....	.....	.....	.....
0.05	"	"	N and O	.....	.....	.....	.....	.....
1.00	cu. meter illuminat'g gas has a heat value of						5,943	calories.

"One hundred kilos coal give 28.2 cubic meters of these gases—that is, about 4½ cubic feet of gas to the pound; 5 kilos tar; 10 kilos ammoni acal water, and 70 kilos coke. Ten kilos water contain 6.2 cubic meters oxygen, and 12.4 cubic meters hydrogen. The 28.2 cubic meters of gas obtained from 100 kilos coal will, according to the previous analysis, contain:

H	11.2	cubic meters.
CH_4	11.2	" "
CO	2.4	" "
C_2H_4	1.3	" "
CO_2	0.7	" "
N and O	1.4	" "
Total	28.2	cubic meters, about.

"If to these gases are added 12.4 c. m. hydrogen, and if we let 6.2 c. m. oxygen with coal form 12.4 c. m. carbonic oxide, and 0.7 c. m. CO_2 with coal, form 1.4 c. m. CO, then the whole volume of carbonic oxide will be 16.2 c. m., and the whole volume of hydrogen will be 23.6 c. m. Of these 23.6 c. m. hydrogen it is supposed that 4.8 c. m. have been carbureted into 2.4 c. m. light hydrocarbons CH_4. In the manufacture of water gas the analyses show that 10 per cent. of the hydrogen has been carbureted in passing through the glowing coke. In this apparatus this passage must be done five times, wherefore I consider that 4.8 c. m. is a fair average figure. The light hydrocarbons should, therefore, reach a volume of 11.2 + 2.4 = 13.6 cubic meters. When all these gases are added together the result will be about as follows from 100 kilos of coal:

18.8	c. m.	hydrogen	3,070 =	57,700 calories.
13.6	"	light hydrocarbons...	9,500 =	128,200 "
16.2	"	carbonic oxide.....	3,000 =	48,600 "
2.6	"	heavy hydrocarbons..	15,000 =	39,000 "
1.4	"	nitrogen	.....	..... "
52.6	"	gas at 5,200 calories.....	=	273,500 "

In the old process about 30 per cent of the coal is gasified. In this process we obtain nearly double the quantity of gas by expending only 8.36 per cent. more of the coal in the shape of coke:

Because	12.4	cubic meters	hydrogen	has taken up		6.74	per cent.	C.
	0.7	"	"	CO_2	"	"	0.37	" "	C.
	2.4	"	"	CH_4	"	"	1.25	" "	C.
							8.36	" "	C."

Mr. Westman also gives an elaborate statement of the heat required to gasify one kilo of coal, which the writer has not time at present to reproduce; the sum, however, is 495 calories, which is obtained by consuming 0.089 kilos of coke, which includes the fuel required to make steam in the boiler, the latter being heated—as shown on the diagram—by the waste heat from the apparatus.

This, then, is the latest novelty in the gas making process and apparatus patented. That the coal may run together in the coal chamber and prevent the passage of the heated gas which is to carbonize it, is a thought which may have occurred to every gas maker who has read this paper; but it may be stated that Mr. Westman seems to be a man who has thoroughly studied the subject in all its bearings, wherefore, *perhaps* this may be "The Process of the Future."

The Geyer-Bristol Meter for Direct and Alternating Currents.

[President Morton's lecture before the Society of Gas Lighting (see JOURNAL, *ante*, p. 139) contained reference to the Geyer-Bristol meter for measuring electric currents. In completion of that reference we herewith give an illustrated description of that instrument, prepared by Prof. W. E. Geyer.]

In the meter about to be described we make use use of the heating effect of the current. Electric measuring instruments depending on this heat effect are not new, as in the Cardew voltmeter we have an application which has found much favor. Here the current of greater or less strength traverses a long, thin wire, heats it more or less, and the direct expansion is a measure of the current, and indirectly of electromotive force.

In an ammeter it is necessary to keep down the resistance, and I therefore doubt whether direct expansion can be usefully applied for this purpose; for the actual elongation of a bar of metal, even when raised through a considerable range of temperature, is very small. In the familiar compound bar we have a case where a very small actual elongation produces a relatively very great lateral displacement.

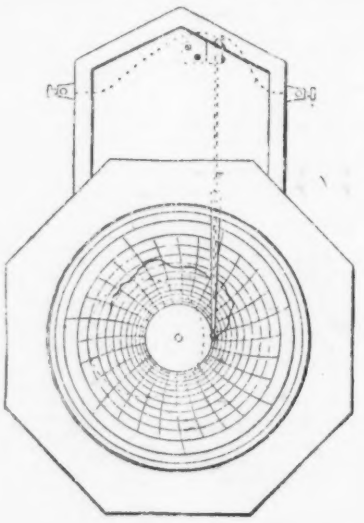


Fig. 1.

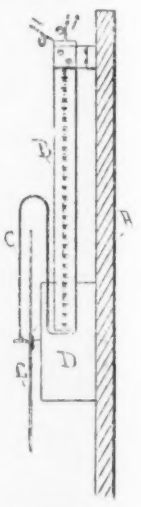


Fig. 2.

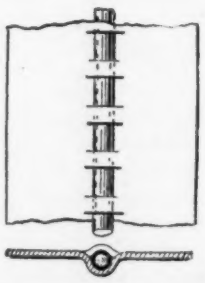


Fig. 3.

I think I shall best be able to explain to you our meter by recalling to your minds this old device. In the simplest compound bar two strips of metal, which have different coefficients of expansion, are securely soldered flatwise along their entire length. Brass and steel are metals frequently employed. On heating, the brass expands more than the steel, and, in consequence, the bar bends, becoming convex on the side of the brass. When such a bar is heated by the passage of the electric current it will deflect, and this deflection may be made a measure of the current. The disadvantage of such an instrument would be that atmospheric changes of temperature would also cause deflection, so that troublesome corrections would have to be introduced.

In our meter we also use a sort of compound bar, but eliminate at once the effect of the surrounding temperature by taking metals whose coefficients of expansion are the same or sensibly equal; in fact, we take the same metal. Our first form of construction was as follows: A wire of German silver is laid upon a strip of German silver of considerably greater cross-section and radiating surface. The wire and strip are soldered together at one end, separated for the remainder of the length by a film of mica, then tied together at frequent intervals with silk or other insulating material, and suitably supported or clamped at the unsoldered end. If now a current, either continuous or alternating, is al-

lowed to enter the strip at one end, it runs along its length, there enters the wire, and leaves the instrument at the other end of the wire.

For a given current the wire, on account of its greater resistance, and also on account of its smaller radiating surface, becomes hotter than the strip. In consequence of the difference of expansion the bar bends, becoming convex on the side of the smaller conductor. This combination we call a differential bar.

We would also state that inasmuch as the results obtained by the use of this instrument are due to the excess of the heating effect of an electric current upon one portion of the bar, or its equivalent, over the other, it is in a measure immaterial to the principle of the invention whether the current which produces the differences in temperature be caused to heat the two parts directly or indirectly. For example, the more expansible part, in lieu of being included directly in the circuit, may be arranged in close proximity to, but insulated from, a wire or conductor which is heated by the current. The other part or element may be in the circuit or not, but in either case formed or arranged to be less sensibly heated than the other.

It will readily be seen, however, that to heat one or both of the parts of the device in this manner would be clearly equivalent to connecting them both in series in an electric circuit. Unlike the case where magnetic action is employed, the force here available is very considerable, so that, to make the instrument self-recording, it is only necessary to attach an inking device to the free end and move in front of it a properly ruled chart. In this respect we have no difficulty whatever. My associate, Professor Bristol, who has done the larger part of the work, has, since our first experiments, very much simplified the method of constructing the differential bar, and the one used in the instrument exhibited was made by placing a flat strip of German silver between a pair of dies which make alternate depressions and elevations along the length of the bar; the wire, insulated with asbestos, was then slipped in the tube-like space thus formed, and the whole pressed between plates provided with grooves of the proper depth so as to leave the wire to one side of the center line and at the same time to insure its being held firmly by the little bridges along the length of the bar. Since the bars can be constructed essentially by these two machine operations, it is evident that they may be readily reproduced, and at very small cost. We have determined experimentally the best relation between the cross-section of the strip and wire to give maximum deflection.

In the illustrations, Fig. 1 is a general view of the differential bar, mounted in a case, with inker and recording dial. Fig. 2 is a side view of the important parts, in which *A* shows the supporting framework; the differential bar is shown at *B;* the inking pointer attached to bar is indexed at *C; D* presents the clockwork moving dial; the revolving dial for receiving record is shown at *E*.

Fig. 3 shows a small section of the bar, with cross-section on an enlarged scale.

[The inventors, having asserted that the instrument could readily be made integrating, did not at first perceive the desirability for such action, although we believe they are now engaged in perfecting this principle in the apparatus.]

Liability of Gas Companies for Injuries from the Escape of Gas.

Now that our American courts are being appealed to on this score, the following (from the *Gas Review*) reference to certain celebrated English cases will be found interesting:

A few very important cases have been decided in the superior courts upon this subject. In that of "Blenkiron vs. Great Central Gas Consumers Company" (30 L. J., 317), the declaration by the plaintiff stated that he was possessed of and carried on the business of a warehouseman in a certain building in the city of London, and owned various goods therein, and that the defendants were employed in laying on gas to a house adjoining the warehouse, but they did their work so negligently that the gas escaped and ignited, whereby the house referred to was set on fire, and the flames from which set the plaintiff's building on fire and several of his goods therein were burnt and injured. It was contended by the counsel for the defendants that the action was not maintainable, as the damage alleged was too remote, and was unconnected with the alleged negligence of the defendants. It was further pleaded that it should be shown that the damage was the natural and inevitable result of the defendants' negligence, but it was quite consistent with the declaration that the injury was caused by the negligence of the owner of the adjoining house, in omitting to do all he reasonably could to extinguish the fire before it spread to the plaintiff's premises. Defendants' counsel also urged that the declaration ought to have gone further. It should, it was asserted, have alleged that there was no default in the owner of the premises in which the fire broke out. It was held by Chief Justice Cockburn and Justices Hill and Blackburn that the plaintiff had a good cause of action, that it was unnecessary to urge negative negligence in the owner of the adjoining house in extinguishing the fire before it communicated with the plaintiff's premises, and that the plea of not guilty would put in issue the defendants' negligence. In the judgment given by the Chief Justice he stated that he had a strong opinion that "a person against whom an action is brought for an injury which flowed naturally from his wrongful act cannot be heard to say that but for the intervention of another party the wrongful act might have been prevented. The meaning of the declaration is that the injury was the consequence of the negligence of the defendants. If it should turn out that it arose by reason of something which ought to have been done by the owners of the house in which the fire broke out, the injury will not be one for which the defendants are responsible." Again, in other litigation in the same case (2 F. and F., 437), in an action against the Company for negligently allowing the escape of gas from their main into premises where lights were known to be burning, the case for the plaintiff being that the gas escaped from an open window nearly level with the trench from the main, after an aperture had been made in the main for the insertion of the service pipe, it was held that even if the jury thought the gas so entered, it was still a question for them whether the defendants' servants might reasonably have foreseen it, and were bound to have the window closed.

In this instance the declaration stated that the Company was engaged in laying on gas to premises contiguous to those of plaintiff, and that defendants or their men so negligently and improperly conducted themselves in so doing that on account of this negligence gas escaped from their main into the before-mentioned contiguous premises, and ignited and exploded, in consequence of which such premises were set on fire, and by the flames therefrom the buildings of the plaintiff were ignited. The contiguous premises referred to were those of Messrs. Morley, and had been lighted by the gas of another Company. The defendants had been employed to supply gas for those premises, and on the day of the explosion their men were engaged in the work necessary for laying on the gas thereto. The pipe from the other Gas Company (the Chartered) entered the premises through a hole in the basement, and they had even enlarged the hole, and likewise made a trench from the wall to their main, about 3 feet distant. Before proceeding further they asked the persons on Messrs. Morley's premises if it were necessary that the gas burners in the basement should be alight, and they were told that it was. They then tapped a hole in the main in order to admit the service pipe. There were windows in the basement through a little hole on the level of the pavement. The meter of the other Gas Company was close to the hole in the wall. A little before eleven o'clock a strong smell of gas was noticed in the basement, and shortly afterward there was an explosion which set the house in flames, and also ignited the plaintiff's house adjoining.

The case of the plaintiff respecting negligence was that the work of tapping the main for the admission of the service pipe should not have been done without a process called "bladdering," which consisted in the insertion of a kind of wedge in the main below the orifice cut for the admission of the service pipe, for preventing the escape of gas through that aperture. It was suggested that there had been a current of gas along the trench and through the hole and window into the basement, where lights were burning, and which ignited and exploded the gas; that this was a result which might properly have been foreseen; and that, as it was known that the lights were there, and the simple precaution mentioned would have prevented all danger, its omission was negligence, that rendered the defendants liable for damages. The witnesses, however, who were called for the plaintiff could not go the length of stating that the precaution was general, nor that it was done in many cases. Skilled witnesses were called for the defendants, to prove that it was not a necessary or ordinary precaution. On the contrary, some of the defendants' witnesses admitted that under the circumstances it would have been proper to adopt every precaution to prevent risk or ignition of the gas by means of the lights which were burning, and that it would have been advisable to close the windows or any other opening into the house before permitting the gas to escape, as it would be sure to ignite after a certain quantity of it had entered the inclosure where the lights were burning.

In addressing the jury on the subject the learned Judge said that "there were two questions for them to determine—(1) whether the gas which exploded proceeded from the defendants' main, and (2) whether, in anything which their servants did or omitted to do, there was such negligence as to make the defendants responsible. The first point depends on the facts, and mainly on this—whether the escape of gas was

gradual or sudden; for if sudden, it probably was from the hole opened by the defendants' servants in their main. As to the second, the real question you have to determine is whether there was negligence on the part of defendants' men, for if so the defendants are responsible. That negligence may be either in omitting to do something which in the exercise of ordinary care and skill they ought to have done, or in the doing of an act dangerous in itself under circumstances in which it cannot, consistent with ordinary care and prudence, be done. The ground of negligence put forth in the opening appears to have been either abandoned or not so much relied upon at the close of the case. The main ground now relied upon by the plaintiff appears to be this—that the whole thing was done with a careless disregard to the safety of the adjoining premises; that care should have been taken to prevent the entry of gas into the premises where lights were known to be burning. And upon that the question is, whether the Company's servants did what was necessary with reference to ordinary and reasonable care. That the operation was one of some danger cannot be denied. Not only does the event prove it, but the witnesses all concur in this, that to allow a quantity of gas to escape into premises where lights are burning was necessarily attended with danger of ignition, and must have been known to be so; and those who carry on operations dangerous to the public are bound to use all reasonable precautions—all the precautions which ordinary reason and experience might suggest to prevent the danger. It is not enough to do what is usual, if the course ordinarily pursued is imprudent and careless; for no one can claim to be excused for want of care because others are as careless as himself. On the other hand, in considering what is reasonable it is important to consider what is usually done by persons acting in a similar business. Now, it appears that the hole in the wall was stopped up, but the window was not closed; and this is the negligence now mainly imputed by the plaintiff. On the other side it is contended that it was not to be expected that the gas would go through the window. Here two questions arise: First, did it do so? and secondly, ought the men to have seen that it might do so? Was there a want of proper care and precaution in allowing the escape of gas from the main without first closing that window? Morley's men were asked to put out the lights, but this is not an action by Morley, and I do not know that contributory negligence on his part would be an answer to the action by the present plaintiff. It is for you to consider whether the defendants' servants ought not to have either insisted on the lights being put out or have the windows closed; and if they did what was necessarily dangerous under circumstances making it additionally dangerous, with a want of due care, find for the plaintiff; if not, for the defendants." The jury were directed as to whether the defendants' gas caused the explosion, but were unanimous in finding that they used all reasonable precaution.

In the case of Burrows vs. March Gas and Coke Company (41 L. J. Ex. 46), the defendants contracted to supply the plaintiff with a service pipe from their main to a meter on his premises. They, however, laid down a defective pipe, from which the gas escaped. A workman in the employ of a gasfitter was engaged by the plaintiff to lay down pipes from his premises, and the former negligently took a lighted candle to find out whence the escape proceeded. An explosion then occurred, whereby damage was occasioned to the plaintiff's premises, and he therefore brought an action to recover compensation from the defendants. The jury found that the pipe was defective, that the workman was guilty of negligence in using the candle, and they also expressed an opinion that the defendants should have tested the service pipe. A verdict having been entered for the plaintiff for £404, a rule to set aside this verdict, and to enter a verdict for the defendants (or to reduce the damages to a nominal sum) was granted, and subsequently discharged by the Court of Exchequer. The defendants having appealed, the Exchequer Chamber affirmed the judgment of the Court below, by holding that the plaintiff was entitled to recover.

In one of the decisions pronounced in the case by Chief Justice Cockburn he stated, among other remarks, that "the defendants seek to make the negligence of the servant of Bates, the gas fitter, who was employed by plaintiff, the negligence of the plaintiff himself. I do not think that that proposition can be maintained. Bates was not the servant of the plaintiff, nor was Bates' man the servant of the plaintiff. Bates was employed as an independent tradesman to do work with respect to this gas apparatus, which apparatus, so far as the service pipe was concerned, had been furnished by the Company. I do not think if a man employs one tradesman to furnish him with some material upon which another and an independent tradesman is employed to do work, that because there may have been some negligence on the part of the second, which leads to mischief, the first escapes from the consequences of a breach of contract by reason of the negligence of the second. There is another ground on which the case may be put, which is, that the Company, having supplied this service pipe for the purpose of communication between their main and the meter upon the plaintiff's premises, before they discharged their gas, in sufficient quantities to do mischief, into the plaintiff's house, should have taken care to see that the apparatus of which the pipe they had supplied formed a part, was sufficient. They did not do that. I think there was a double negligence; a negligence in furnishing a defective pipe in the first instance, and the negligence in sending the gas in such quantities as to be productive of the catastrophe without having taken care that in the meantime the state of the fittings had been ascertained. I think, therefore, there was a breach of contract on their part, and although that breach of contract would not have brought about the mischief which has led to this action but for the negligence of another party, yet inasmuch as the escape of gas must necessarily be attended with danger, and the escape of gas is the necessary effect of a defective pipe such as was supplied by the defendants. I think that the action was well maintained against them." In the course of another judgment given on the subject, which was by Mr. Justice Blackburn, he said that "it is not necessary to go further in this case than to say that at least there was ample evidence to go to the jury that the defendants supplied a service pipe, and that in supplying it they were bound at least to see that it was reasonably fit to keep in the gas, and as the jury have found that there was a defect in the pipe it clearly was not fit. And for the rest when there is a defective pipe supplied for the purpose of letting gas come into a house, it is the most probable and natural consequence in the world that the gas should flow out of that defect and make an explosive mixture, and the jury were perfectly warranted in finding that it was the natural consequence of that defect that the explosive mixture should catch fire and damage follow." All the other judges who were present when the appeal was heard in this case concurred with these quoted statements and those of the Chief Justice.

In the case of Mose vs. Hastings and St. Leonard's Gas Company (4 F. and F., 324), it was held that a gas company are bound to continue such a reasonable inspection of their mains and pipes as will enable them to detect when there is such an escaping of gas by breakage or imperfection of pipes as may lead to the danger of an explosion, and that if an explosion occurs from a fracture or defect that has existed for several days, during which time it has also been discoverable (on account of the smell of the escaped gas), that is evidence of negligence on the part of the company. It was further decided that it was not sufficient to relieve them from liability, that upon receiving notice of the escape they sent a workman to repair the defect, but who arrived too late to do so. In summing up the case to the jury, Chief Baron Pollock stated that there was testimony here "from which the jury might come to the conclusion that there had not been such due and reasonable care, and without saying that the companies ought every day to send men over the entire district to ascertain whether there was any escape of gas from the mains, at all events it was for the jury to say whether the not sending anyone for several days during which, according to the evidence, the escape of gas and the danger of an explosion was discoverable, was such reasonable care as the companies were bound to keep up. It was clear that there ought to be some system of supervision, and that men should always be in readiness to repair any leakage that might be discovered, and that anything short of these precautions against accidents which were thus liable amounted to neglect for which they would be liable."

Upon this declaration of the law the jury found a verdict for plaintiff with £160 damages. In a foot-note in the authorized report of this case it is stated that a journal in the interests of the gas companies made the following comments on the case which was determined at the Sussex Lent Assizes in 1864, viz., "This ruling of the Lord Chief Baron, if confirmed by the other judges, will impose increased responsibilities on gas companies. An attempt was made at the trial to prove that the mains generally were defective; but it was evident that the accident was not caused by what is generally understood by the term neglect on the part of the gas company, for the main from which the gas escaped had been broken by some heavy wagon passing over it." Since then additional precautions have been taken by gas companies in laying their mains under roads along which vehicles are drawn.

Lastly, in the case of Parry vs. Smith (4 C. P. D. 325), the defendant, who was a gas fitter, was employed by the plaintiff's master to repair a gas meter upon his premises, and in order to do so took away the meter, and in lieu of it made a temporary connection by a flexible tube between the inlet pipe and the pipe communicating with the house. The plaintiff, in the ordinary discharge of his duty, having gone with a light into the cellar where the meter had been, a quantity of gas that had escaped in consequence of the insufficiency of the connecting tube, exploded and injured him. On an action being tried, the jury found that the work

had been negligently done, and that the injury to the plaintiff was entirely caused by such negligence. It was held that the defendant was liable for damages. It is a cause of congratulation to gas companies that so very few cases have been brought against them in our courts on account of the escape of gas from defective mains and pipes, and the negligence of their servants. The public, also, we believe, have but few occasions to complain against them on this subject.

Indian Petroleum.

The *Mining Journal*, in an excellent article on this subject, says:

The prominence given of late to the probability of petroleum replacing coal as fuel for engine furnaces will, we presume, direct attention to the vast deposits of this mineral known to exist in many parts of our Indian Empire, and to one of which we referred in the *Mining Journal* some time ago. Burmese oil was long known, and utilized for various purposes other than for illumination many years previous to our annexation of the southern portion of that country; and although the present condition of Burmah precludes the possibility of working the wells to the full extent of their capabilities, as the anarchy is but temporary, we may as well briefly summarize what is known of these springs before alluding to other deposits in more settled districts of British India.

Petroleum is most plentiful in Upper Burmah—our most recent acquisition. At Teynan-gyoung (*lit.*, "earth oil creek") over 150 wells were worked before the troubles commenced, and, although reliable statistics are not to be had, it has been tolerably accurately ascertained that the yield from these amounts to 9,500 tons or thereabout per annum, the total output from Upper Burmah being nearly 11,000 tons annually. At Pagan, where there are about 50 wells, the oil is obtained in a purer and much more liquid state than from the district previously mentioned. The town of Teynan-gyoung is the center of a small district in which nearly 500 springs are or were worked, but in the most perfunctory manner. The soil of the district consists of a sandy loam resting upon alternate strata of sandstone and indurated clay; under these is a layer of pale blue argillaceous schist of considerable thickness, resting upon coal and impregnated with petroleum. The oil flows into the wells sunk into this schist, and when it fails the holes—for they are little better—are deepened. It may be remarked that no water ever penetrates into these wells except during the rainy season, and then what finds its way there is rapidly evaporated. Methodical boring would no doubt at Pagan increase the yield immensely, and, refined on the spot, a more lucrative business than exporting the crude mineral could be established.

Petroleum is also found, and is worked, at Akyab, Ley Doung, in the Padoung township of the Prome district; at Thayet Myo (lately our frontier station), and also at Khyouk h'pyoo, in Upper Burmah. In fact, wherever shale and sandstone are found in close contiguity, very superficial boring in Eastern India results in bringing petroleum to the surface.

In Western India petroleum has been struck in very many places, chiefly in the vicinity of the banks of the Indus; but the further we get from the highly volatile coal seams of the Eastern district, the more impure, as a rule, the mineral. West of the Indus the oil, even when refined, has a reddish tinge, due apparently to the presence of oxide of iron in the surrounding soil.

It is, however, in the Assam provinces that the extraction and refinement of the mineral affords the most promising outlet for capital. At meeting of the Assam Railway and Trading Company, held some two years back, a shareholder, long resident in Assam, excited some surprise and a little incredulity by asserting that he had seen the huge volume of the Brahmapootra covered for 20 miles of its course with petroleum; and that this statement was no mere figure of speech can be vouched for by the commanders of the river steamers and others who have traveled on that river between Debroghur and Syddia. The greater portion of the mineral comes down the Dehing, a river that flows into the main stream from the south, and takes its rise among the coal-bearing strata of Thikak, the springs from which it exudes being generally beneath the surface of the water, though considerable quantities for local purposes—such as protecting timber used in building from the attacks of white ants, etc.—is obtained from the shale, locally known as clay slate, that abounds in the district. Known to every planter in that part of the province, no attempt has as yet been made to utilize the oil for various reasons. The river steamers, freighted as they are with valuable cargoes of tea, decline to carry it, as its flashing point has been ascertained to be, under certain conditions, as low as 93°, and in the intense heat of the climate of Lower Bengal in the hot, dry months it would be pretty certain to explode; hence we have the remarkable anomaly of kerosene, brought all the way from America, being conveyed into a country where the basis of it runs to waste. Again, our communications with Assam—at least the remote eastern portion of it—are tedious and long, and unless a large demand arose for petroleum sufficient to justify the establishment of a special line of steamers for its conveyance to a market, the product of the Dehing wells could not successfully compete with importations from America. Until such time, therefore, when the valley is traversed by rail from end to end, the oil springs of the Dehing must remain unworked. But the same objections do not apply to the deposits on the south side of the mountains that divide the province into the two divisions, though the steam companies plying on the southern rivers also decline to carry the mineral.

Oil was first found beneath the Lakadong coal seam in the Jaintia hills as far back as 1859, and a sample sent to Calcutta; but at that date the value of the mineral was unknown—at least in India—the find being pronounced of no commercial importance! Shortly after this discovery the working of the Jaintia coal seams was discontinued, and for 15 years petroleum was lost sight of. It was then accidentally brought to light in sinking a well for water on the Massimpore tea estate, within a couple of miles of the station of Cachan, a site possessing every advantage for successful working, having a mile of river frontage, and with a geological formation precisely similar to that of the Pagan in Burmah. As the Jaintia deposit was discovered at the same time as those known as Petrolia, had the then proprietors of the coal mine taken due advantage of the discovery, what with cheap labor, water communication, and the universal demand for kerosene that has arisen all over our great Dependency, there is little doubt that Jaintia would have completely monopolized the supply, besides exporting very considerable quantities to the Australian colonies, China, and perhaps to the United Kingdom.

It is not too late now to oust the American oil from India. The raw material is known to exist in vast quantities throughout the Sylhet and Cachar districts, and rail communication with the coast at Chittagong would enable a company to place the produce of the southern Assam wells in Calcutta at a figure that would defy competition from outside, and yet yield more than a fair margin for profit. We have before mentioned that these districts are geologically identical with Burmah, and an eminent geologist, deputed by the Bengal government some 20 years back, arrived at the conclusion, since amply verified, that the sandstone hills north of the station at Sylhet covered large coal deposits; hence the presence of shale underlying sandstone would indicate an oil-bearing strata situate between two navigable streams sufficiently high above the annual flood mark to be workable throughout the year, and covering an area of some 30 square miles at the back of Sylhet alone. These sandstone hills, it is true, are permeated by water springs; but between these there is ample space for boring, and should water percolate in such quantities through the sandstone as to render successful working abortive, then there are the petroleum jets in the outer Jaintia and Khassia mountains to fall back upon, and as these are located far from any springs, there is no probability of the wells becoming flooded. In working these the construction of roads would be necessary, as in the winter months the streams upon which they abut are merely navigable for the lightest canoes, and transport of the mineral during the cold weather would be preferable, to guard against the possibility of spontaneous explosion. No danger from that cause need be apprehended from storing the oil in Jaintia in the hot weather, the building material used in the district being of such a non-heat-conducting nature as to secure a sufficiently low temperature without resorting to mechanical means to reduce it below the reputed flashing point.

It merely remains to point out those points more readily accessible whose geological formation indicates the existence of petroleum even when exudation is not apparent.

We need not further allude to the sandstone formation in the vicinity of Sylhet. The Jaintia rivers, the Myntadu, Rewai, Burhill, Chengakhal, and Loobah, in which patches or gouts of the mineral are frequently seen, both in the rains and cold weather, as they debouch from the hill, pass through shale formation which in some instance overlies and in others underlies the coal seams. At Bhurghat, at the foot of the hill upon the summit of which the Lakadong outcrop of coal appears, the spring from which the sample sent to Calcutta in 1859 was taken, is situated about one-half mile from the village near the bottom of an abrupt precipice, the mineral trickling down from a crevice in the older sandstone rock; but in the newer sandstone of the broken hills forming an irregular amphitheater east of the village, almost every gully contains springs, a most copious exudation from all of which followed the earthquake of January 10, 1869. The mineral is of the consistency of molasses, but settles quickly in the earthen pots in which the natives

collect it, giving a sufficiency of tolerably clear oil for their purposes, either for dressing wood or outward application for rheumatism. In the adjoining valley of the Rewai most of the known springs are under water, and are easily detected by the succession of patches they throw up to the surface. The banks of this river are very precipitous, clothed with heavy forest, the upper soil silicious mould resting on sandstone, with shale and limestone underneath. Successful boring here would necessitate terracing the side of the ravine above the springs. Lower down the river, at the Bagh Cherra tea estate, is a hill of shale tilted up at an angle of 45°, and 40 feet below the water is a thin seam of coal; large patches of petroleum frequently rise to the surface here, and as the top of the hill is flat, about 100 feet above the river, there would be no difficulty in driving a shaft right through to beneath the coal; but from this point out to the alluvial plains, about a couple of miles, the broken low hills of mixed shale and sandstone contain numerous outcrops of anthracite, the small streams intersecting these hills being thickly impregnated with the mineral, though it oozes up in very minute jets. From the Lallaktral tea estate, for 4 miles to the eastward, the country is of the same formation; then an interruption occurs, and until the Loobah river is reached the outlying hills consist of loose boulders mixed with disintegrated limestone, the water in the mountain streams flowing through which affords no indication of petroleum; but the surface of the Loobah, except in the highest floods, is seldom free from small jets out of the sandstone rocks under the village of Morilli, in the vicinity of which the coal seam, turning sharply to the north, disappears from the surface for nearly 40 miles.

Where the coal again reappears, in the Kopati Valley, petroleum is said to have been found, in the neighborhood of the sulphur springs that exist there; but the position of the place is so remote from communications that it needs no more than a passing remark. Continuing eastward from the Loobah, shale and sandstone is the formation of the country for some 12 miles, and though of closer and stouter consistency than that of Jaintia, is of the true oil-bearing geological indication. The outlying hills on which the Nutwanpore plantation is formed consist mostly of shale, but we are not aware that the presence of the oil has been noticed; from this place the face of the hills is of a very mixed character, old sandstone, lava, gravel, drift and boulders, though shale, here and there, crops out. In the open country, adjacent to the main river of Cachar (the Barak), several bluffs have been worn through by the water, and these are of the same formation as that of the "earth oil creek" in Burmah, and when the river reaches its lowest level in the month of February, the bed is seen to abound with reefs of shale, a huge hummock of which was uphove near Bhanga Bayar, in the earthquake mentioned above, to an extent as seriously to interfere with the cold weather navigation.

The most remarkable similarity of presumed oil strata, between Cachar and Pagan, occurs at the Hattia cascade on the Gogra stream, some six miles from Silchar, where the cutting on the main road has been carried through a low range of hills. Here we have an exact counterpart of the country around Pagan, sandstone and clay in alternate layers resting on the true pale blue argillaceous schist, or shale, but whether coal underlies this latter, boring alone can determine—the immediate surroundings indicate that it does, unless geologists are at fault; but one thing is beyond dispute *id est*, patches of petroleum come down the Gogra, and it is reasonable to assume that such exude from subaqueous springs in the neighborhood of the Hattia. From the station of Silchar right up to the Munnipoor frontier, the shale crops out, now in the river, now on the banks, but above the Gogra we are not aware that indications of the existence of petroleum on the surface of the water have been met with. This, however, may be accounted for from the fact that the geological formation, as one proceeds more to the eastward, becomes denser and more solidified, owing probably to the volcanic action in the interior of the crater, of which the eastern half of the district of Cachar is formed, continuing long after it had ceased to distribute its scoria and lava over the adjoining country; for once clear of the eastern boundary of the crater, and well into Munnipoor, both sandstone and shale become again soft and disintegrated, continuing so until the oil-bearing country in North Burmah is reached, and probably extending into Western China, where we know petroleum is worked.

The Bobun range in the east of the Cachar district abounds in anthracite mixed with shale; but no prospecting for oil has ever been undertaken, though such would probably be attended with success; but the known springs in the less remote localities we have alluded to, all of which are distinctly marked on the Revenue Survey maps, issued at nominal cost by the Indian Government, afford ample scope for capital and enterprise.

With regard to communication, the proposed railway, when once commenced, will put Jaintia within 14 hours of Chittagong. but as probably some five years will be taken up in the construction of the line, in the meantime launches might be employed for towing native crafts, unless the steam companies now plying on the rivers can be disabused of their apprehensions. Government being anxious to develop Assam's resources, no difficulty in obtaining the necessary concessions need be entertained if intending applicants can show that they have sufficient capital at command to undertake business in a thorough manner, and any company who would be satisfied with a moderate, steady dividend would, we take it, obtain the practical monopoly of working the oil-bearing strata of Assam.

Though we have indicated the most promising known localities, it is as well to bear in mind that that range of mountains which runs along, but very few miles inshore, of the Chittagong coast as yet remains unexplored, so that, ere permanently establishing works in the interior, it would be but prudent to ascertain whether or not petroleum exists within their recesses, for, given similar prolific capabilities of the wells, success will depend upon the proximity to the shipping port, and hence would incline in favor of those whose works were in the immediate vicinity of such.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Philadelphia newspapers are agitating the subject of cheaper gas for that city, and have the advantage in that appearances at least all favor such a move. If we mistake not, the current gross rate is $1.50 per 1,000 cubic feet, and despite the fact that the supply of gas for public purposes is not directly charged for—although the ordinary consumers indirectly pay for the same—there is no good reason why Philadelphia should not have as cheap gas as that enjoyed by New York, where, as almost every one knows, the price, by mandate of the State Legislature, rules at $1.25 per 1,000. Still, New York is satisfied to repave her streets, and to perform other services conducive to the comfort of her inhabitants, by means of the moneys received from a direct tax, while Philadelphia seems to insist that similar work there shall be paid for by the gas consumer. At least such seems to be General Wagner's way of looking at it; for, on being recently questioned as to his views on the propriety of reducing gas rates in Philadelphia, he is said to have replied: "I am not in favor of a reduction. The city wants all the money it can get for improved streets and other purposes, and the profits of gas manufacture can be very well used in that way." Profits can be very well used in any way, we suppose; but the equity of such discrimination is hard to decipher.

THE Detroit Council still keeps up the discussion on the good business policy of committing the city to the operation of a municipal electric lighting plant. A few of the wiser ones insist that the plan is sure to lead them from a bad present to a worse future, while the enthusiasts predict that it would result in a complete deliverance of the municipality from the "clutches," etc. During a recent debate on this topic in Council, Ald. Kellogg, when hard pressed for a suitable reply to a query propounded by an opponent of the measure, replied that the passage of the ordinance did not of necessity mean that the city should at once install and operate a plant on its own account, but in the event of acquiescence the city could hold the right as "a club" to subdue the Brush Company, in case the latter moved at too fast a pace.

ANOTHER New Jersey gas bill (presented by Mr. O'Neill, and indexed as No. 102) provides that the Governor shall, in cities of the first class, appoint an Inspector and an Assistant Inspector of gas and meters. The former is to be paid $1,500, and the latter $1,000 per annum. It is also provided that tenants are not to be called upon to pay the arrears of former tenants, in the matter of unsettled gas accounts. This latter mode of procedure ought to be abolished, for it seems to us to be indefensible. The same policy prevails in Philadelphia; and it ought to be abolished there, too.

THE Harrison (N. J.) Electric Lighting Company, which is under contract to light that place, for five years from the 1st prox., with 70 arc lights of 2,000-candle power each, to be paid for the same at the rate of 36 cents per arc per night, seems to be strangely hampered by a lack of funds. The promoters did ship a lot of poles over the Erie road, and did employ a number of laborers to dig the post holes; but the Erie freight agent kept the poles because the carriage bills were not paid, and the laborers are anxiously looking for the paymaster, who seems equal to the task of keeping company with the funds.

THE Milford (Mass.) Gas Company supplies gas to about 400 consumers, and the Hopedale district absorbs almost 33 per cent. of the total.

THE capital stock of the Spencer (Mass.) Gas Company has been increased by the issue of 100 shares, equal to $10,000.

AT the annual meeting of the Pittsfield (N. H.) Gas Company the retiring board of officers was re-elected. The only change reported in the list of Directors was the substitution of Chas. H. Lane for D. C. Knowlton.

MR. WILMER F. LUBBE, late Superintendent of the Conshohocken (Pa.) Electric Light and Power Company, died on the morning of the 7th inst. He was a graduate of the University of Pennsylvania.

ONE week ago we noted the introduction to the Pennsylvania Legislature of a measure proposing to assure exclusive privileges to Pennsylvania gas, electric light and power companies, in their respective districts, until they shall have during five years earned and divided among their stockholders dividends equal to 8 per cent. on their capital stock. Taken all-in all, the bill seemed to be such a good thing for the proprietors of investments of the sort specified, we inquired further about the measure, and are now enabled to give the following further details concerning it. The prominent sections are: "*Section III.*—That the first clause of section 34, of the Act of 1874, relating to corporations, shall read as follows, viz.: Where any such company shall be incorporated as a gas company, or company for the supply of light, heat and power by electricity, or the supply of light or heat to the public by any other means, it shall have authority to supply with gas, or light, heat and power by electricity, or light or heat by any other means, the borough, town city or district where it may be located, and such persons, partnerships or corporations therein residing or adjacent thereto as may desire the same, at such price as may be agreed upon; and also to make, erect or maintain the necessary buildings, machines or apparatus for producing or manufacturing gas or light or heat by any other means, and distributing the same, with the right to enter upon any public lane, alley or highway for the purpose of laying down pipes and conduits, erecting poles and stringing wires thereon, or altering, inspecting or repairing the same, doing as little damage to said streets, lanes, alleys or highways, and impairing the free use thereof as little as possible, and subject to such regulations as as the Councils of said borough, town, city or district may adopt in regard to grades, or for the protection or convenience of the public travel over the same.

"*Section IV.*—That the third clause of section 34 of said Act shall read as follows: The right to have and enjoy the franchises and privileges of such incorporation for the supply of gas, light, heat and power by electricity, or light, or heat, or any other means within the district covered by its charter, shall be an exclusive one, and no other company shall be incorporated for that purpose until the said corporation shall have from its earnings realized and divided among its stockholders during five years a dividend equal to eight percentum upon its capital stock. Provided, that said gas and water corporation shall at all times furnish pure gas and water, and any citizen using the same may make complaint of impurity or deficiency in quantity or quality, or both, to the Court of Common Pleas of the proper county, by bill filed, and, after hearing the parties touching the same, the said court shall have power to make such orders in the premises as may seem just and equitable, and may dismiss the complaint or compel the corporation to correct the evil complained of.

"*Section V.*—Any person wilfully or maliciously injuring, contaminating, or destroying any of the works of said company shall be guilty of a misdemeanor, shall be indicted in the Court of Quarter Sessions, fined not more than $500, and imprisoned not more than a year, either or both, at the discretion of the Court; but such criminal prosecution shall not impair the right of the company to obtain full compensation by damages in a civil suit.

"*Section VI.*—Any company furnishing gas, water, electric light, heat or power to any tenant whose goods shall be taken by virtue of any execution, shall be entitled to claim and receive out of the proceeds of sale any sums of money due for gas, water, electric light, heat or power at the time, and not exceeding three months' bills.

"*Section VII.*—Any existing company for the supply of light, heat, or power by means of electricity heretofore incorporated, under the provisions of the general corporation act of April 29, 1874, and engaged in business may accept this act in the usual way, thus acquiring all the rights, privileges, etc., conferred by it; and all the property rights, privileges and easements belonging to such corporations theretofore acquired by gift, grant, conveyance, municipal ordinance and assignment shall be and the same are hereby ratified, approved, confirmed and assured to such corporation with like effect and to all intents and purposes as if the same had been originally acquired under authority of this act, and such corporations shall thereafter be governed by this act. The Governor shall upon such acceptance issue new letters patent to said corporations for the same territory covered by original letters patent, and in the same name."

THE fuel gas plant at the watch factory (Waltham, Mass.) is progressing satisfactorily, the Company having employed Mr. Wm. Tarbell, formerly in charge of the Waltham Gas Company's plant, to superintend the completion of the construction work. The holder to store the gas to be used in connection with certain divisions of the process of watch making—such as dial baking, soldering, etc.—has a capacity of 20,000 cubic feet. It is expected that the plant will be in practical operation by the first prox.

MR. RICHARD J. MONKS delivered a very interesting lecture on the subject of "Artificial Lighting," before the members of the Boston Electric Club, No. 7 Park street, Boston, Mass., on the evening of the 6th inst. His *resume* of the history of artificial lighting was very well put together.

THE Jacksonville (Fla.) Electric Light Company offered at a recent meeting of the local Board of Public Works, the following lighting proposition in respect to the public service: 20 arcs, at $150 each, per year: 30 arcs, at $148; 40, at $146; or 50, at $144. If incandescent lamps were preferred, the service and charge therefor to be thus graded—candle power of each lamp to be 25: 120, at $33.33 each; 160, at $32; 200, at $30. The Sun Vapor Street Light Company, of Canton, Ohio, wanted to supply 100 naphtha lamps, at an annual charge of $25 per lamp. As we understand it these offers apply only to the districts of the city (chiefly suburban) not reached by the mains of the local Gas Company, which has a contract with the authorities to maintain 100 gas lamps in the city proper, these being paid for at the rate of $35 each per year.

THE proprietors of the Newburyport (Mass.) Gas Company have applied for permission to alter the incorporated title to that of the Newburyport Gas and Electric Company.

GLOUCESTER, Mass., has come to an understanding with its artificial light suppliers. The concessions made will enable the borough to keep arc lamps over its roadways.

WE understand that the yearning for a municipal lighting plant at Bangor, Me., is to be satisfied, the City Council having voted to contract with the Brush Company for the installation of the necessary equipment for a 165-light outfit, the generating station to derive its power from the dam at the local water works. The price agreed upon is just short of $26,000—in fact, to be precise, the figures stand $25,909.

THE new owners of the Middleboro (Mass.) Gas and Electric Light Company have determined to abandon the "pure oil gas" method hitherto pursued at this plant. A water gas system will probably take its place. We understand that the electric annex is to be made a prominent feature of the Company's business.

ALTHOUGH the annual election for control in the Consolidated Gas Company, of Baltimore, Md., will not occur until midsummer, parties inimical to the present management are now soliciting proxies, basing their requests for such on the ground that Capt. Hall and his associates are far too conservative in their policy. Some of the agitators for a change go so far as to assert that a fair dividend is being earned on the share capital, which earning is withheld unjustly from the shareholders. It is just possible that some unscrupulous stock jobber is at the bottom of the whole affair, and that he wishes to create the impression that the Consolidated Company is either now able to pay, or is in a fair way of earning a dividend so that he may unload at something above the present ruling quotation—from 45½ to 46½. At any rate it is only by close working that the Company has within the past 7 months been able to pay off $100,000 of the $260,000 debt that stood against it when the consolidation was effected last summer. Further, this ought to be taken as doing pretty well, too; for, if we mistake not, it is loaded with interest obligations that call for the annual payment of a sum not far from $385,000. We understand the malcontents are suggesting Judge Wm. A. Fisher as a likely candidate for the Presidency, and while the Judge is a clever gentleman, we are inclined to think he is no better fitted for the place than Capt. Hall; in fact not so well. Indeed, it seems quite safe to predict that the Captain will be found to have had "a majority of all the ballots cast" when the next stockholders' election shall have been declared closed.

THE capitalists who proposed to operate an electric lighting plant at Williamstown, Mass., have decided to reconsider their determination. On the other hand, the project to construct a gas works at this point is being vigorously boomed, with every prospect that by September 1st. the plant will be in operation.

TOWARDS the close of last year the good people of Evansville, Ind., were greatly stirred up over the result of an application made to the Council by the promoters of the Citizens Electric Light Company, the latter being desirous to operate an electric plant in opposition to that owned by the Evansville Gas and Electric Light Company. Under the conditions of the city ordinance governing the latter Company there could be but one result in respect to the fate of the application; and the inevitable overtook it in the shape of a refusal. The electricians then appealed to the courts for a mandamus to compel the Council to change its decision, and the fun grew fast and furious. The prior aspect of the case, however, was as placid as a mid-wood pool on a sultry day in summer, when compared with the rumpus waves that followed the final action of the applicants to court; for right in the midst of the mandamus proceedings they dropped their case, and, as it is supposed, the Evansville Gas Company was not a long distance away from where the loss occurred. In other words, the electricians' presumable loss was the Evansville Gas Company's certain gain. This action nettled the "competition in lighting" cranks' forces to such a degree, that accusations implying falsehood, blackmail, subterfuge, subornation, etc., were flying about in that profusion which is said to have been characteristic of the foliage of certain sylvan scenes favored by the deities of mythology. One of the leaders in this wordy warfare was the editor of the Evansville *Courier*, who managed to direct his attacks towards the Hon. Azro Dyer, Judge of the Evansville Superior Court, and also President of the opposition Company. Time did not heal the Judge's scars, wherefore he now sues the *Courier* man, praying that a $50,000 plaster be spread over the raw spots which defendant made in his character. Seemingly character comes high in Evansville; but it must be maintained there as everywhere. The termination of those mandamus proceedings did look a little peculiar, even to those at a distance from the scene of the same.

GENERAL HICKENLOOPER is said to have remarked the other day to Mr. Geo. B. Kerper that his (the General's) faculty of recollecting instances of his early youth reverted even to his infantile days. "For instance," said the General, "when I was in my sixth month, a 12-year old cousin of mine was one day carrying me in her arms through the cow lot at our family place—I remember distinctly that the family had a hooking cow which was usually shut up—when the animal, which had managed to escape from imprisonment, made a charge at us. My cousin started across the lot as fast as she could run, and I recollect now how desperate a chase it was. The horns of the animal were lowered, and she swept down on us like an avalanche. Her breath fairly smoked like a furnace as she rapidly gained on us, and I was almost skewered upon her horns when my cousin reached the gate and dashed through as the horns we had just escaped were driven against the fence. It was a very narrow escape, and I can recall it now just as it happened." This "unaffected recital" of a great and good baby's danger teaches two things: First, that the General's memory is not of the hot-house variety; second, that it is all now made plain how it is that he is so successful in taking the bull by the horns.

THE Dedham and Hyde Park (Mass.) Gas and Electric Light Company's proprietors are, under the leadership of Mr. W. Eliot Fette, making a sturdy fight for permission to supply electric light and power to the residents. The opposition emanates chiefly from the Dedham Water Company, which also wishes to engage in the lighting business—not directly, perhaps, but as sponsor for the Dedham Electric Light and Power Company. At one of the hearings the President of the latter admitted that his Company had no capital, "and did not know where to look for any." Rather a lame duck, this, but with the flying instinct not badly blunted. It is quite likely that Mr. Fette's Company will secure the necessary permission, and is now ready for business. In fact, sample lights are now being maintained.

THE Natural Gas Light and Fuel Company is installing, at the South Station of the Chicago Gas Light and Coke Company, a Springer cupola water gas apparatus, the same to have a capacity of 2½ millions cubic feet per diem.

THE gas and electric lighting interests of Easton, Md., have agreed to combine their forces. The competition was fierce while it lasted.

We are not sure that the following is a fixed fact, and give it for what it is worth, our doubt as to its correctness being based on the fact that the procedure looks all too revolutionary for staid and sober Chelsea. Our information is to the effect that the Mayor and Board of Aldermen of Chelsea, Mass., on the simple application of Mr. J. H. Cunningham and others, without notice to the interests adversely affected, and without any preliminary hearing, granted the parties named a franchise to operate a gas works in opposition to the plant that for years has been a credit to the city, and to the probity of its owners as well. The end, however, is not yet, for the opposition must next encounter the Gas Commission, which is not so pliant as the average City Council.

IN continuation of our excerpts from Gas Inspector Hinman's report on gas and gas meters (Massachusetts, 1888), we note his explanation that the increase in suspected meters (182 were examined in '88 against 124 in '87) is to be charged to the fact that one Company sent to the State office every one of its meters about which any dissatisfaction had been expressed. Two thirds of the reinspected meters that showed an average error either way of 5 per cent. and over had been in use for 10 years or more. In connection with this Inspector Hinman rather humorously remarks, "Although many meters that have been in use 18 or 20 years have been found correct when retested, there is no doubt but that it is desirable that the meters should be retested after they have been in use some years." Further on the Inspector places the limit for safe use (in respect to other than new meters) at from 8 to 10 years. We differ from him in this allotment, and hold to the view that other than new instruments, even when assigned to the duty of measuring a gas best calculated to extend or conserve their efficiency, should be tested once every 5 years. Although the general average of the instruments inspected is returned at 0.82 against the consumer this year, no allowance in the average tables is made for the two instruments that failed to register any of the gas that passed through them from the mains to the burners. Again, during the period covered by the last decade (1879 to 1888, inclusive), it is shown that 1,336 meters of all sizes were examined by the Inspector, and the grand average of the same in error is shown to be 0.425 per cent. against the gas companies—always excluding the stopped meters from the calculation. Having admitted the impossibility of determining the average error of all meters in actual use, Mr. Hinman is of the opinion that the probabilities all point to the error being in favor of the consumer, and clinches that statement by stating, "it is also probable that gas is measured more accurately than the majority of other articles of household consumption." The tests for illuminating power showed the average quality of the gas supplied throughout the State to be well above the standard—15 candles—the only delinquency being reported in the instance of the Cottage City product, where on one occasion this fell below the standard 1.7 candles. In respect to sulphur contamination, sulphureted hydrogen was disclosed in one instance at Adams, and the legal requirement as to freedom from ammonia content was exceeded at 13 different points in the State, Roxbury and South Boston being each on the delinquent list on four different occasions. The Inspector gives a table of 64 examinations, both for candle power and gas composition, and thereon comments as follows: "Perhaps the first thing in these analyses that attracts attention is the fact that, for the same candle power, water gas requires a larger proportion of illuminants than coal gas. This is accounted for by a difference in the composition of the illuminants, by the larger proportion of marsh gas in coal gas, and by the fact that, generally speaking, water gas contains more carbonic acid than does coal gas, and carbonic acid diminishes it. The water gas analyzed was produced by eight different styles of apparatus, and, as shown, varied considerably in composition: In the "baby" or "boot-leg process"—which differs essentially from the other processes—a mixture of steam and naphtha is passed through a retort heated from the outside and filled with lime. The steam is decomposed, its oxygen uniting with carbon from the naphtha to form carbonic acid, setting free hydrogen; the heat seems to be so low as to prevent the formation of carbonic oxide. The analysis of this gas here given, and which agrees closely with the analysis of the gas by the same process, but from another place, given in the last report, is remarkable for the large percentages of air and carbonic acid, and for the small percentage of carbonic oxide. It may be cheaper to add oil gas to keep up the candle power than to take out the carbonic acid, but the addition of so large a percentage of air is scarcely advisable. Gas containing a large proportion of air or carbonic acid requires to be burned under a low pressure to obtain the best results; and it is very easy, by using small burners, to burn it so as to obtain little light. The gas at Cottage City also contained a rather large proportion of carbonic acid." We will close our reference to the Inspector's report (which is in every sense an admirable

paper) by reprinting from it the following table giving the results of burning rich gases carrying varying proportions of carbonic acid, the leading practice in the experiments being thus roughly stated. The gases were burned from Bray's slit burners, marked for from 2 to 7 feet per hour. The mixture was burned so as to give a well-proportioned flame of about 20-candle power, the aim being to burn each mixture under the ordinarily occurring conditions best suited to it. The carbonic acid was measured by a small meter reading to ten-thousandths of a foot, and mixed with the rich gas before the ordinary photometric meter. The Methven slit was used as a standard. The gas used in the first series of experiments was coal gas enriched with naphtha gas. In the second and third series different grades of naphtha gas, containing some nitrogen, were used. The results are appended:

Percentage of Carbonic Acid.	Rate of Burning.	Observed Candle Power.	Candle Power for five feet per hour of Mixture.	Loss of Candle Power.	Percentage Loss of Candle Power for each one per cent. of Carbonic Acid.	Candle Power for five feet per hour of Gas.	Loss of Candle Power.	Percentage Loss of Candle Power for each one per cent. of Carbonic Acid.
0	4.74	20.0	21.2	.....	.....	21.2	.....	.....
2.0	5.20	20.0	19.3	1.9	4.4	19.7	1.5	3.5
3.3	5.59	20.2	18.1	3.1	4.4	18.7	2.5	3.6
4.4	6.00	20.8	17.3	3.9	4.2	18.1	3.1	3.3
5.2	6.11	20.2	16.5	4.6	4.2	17.4	3.7	3.4
6.2	6.35	19.7	15.5	5.7	4.3	16.5	4.6	3.5
0	3.43	19.8	29.0	.....	.....	29.0	.....	.....
2.0	3.72	20.4	27.4	1.5	2.7	28.0	1.0	1.7
2.7	3.79	20.5	27.0	1.9	2.5	27.8	1.2	1.5
3.2	3.77	20.1	26.6	2.4	2.6	27.5	1.5	1.6
3.5	3.90	20.5	26.3	2.7	2.7	27.2	1.7	1.7
3.8	3.99	20.6	25.8	3.2	2.9	26,8	2.2	2.0
5.5	4.31	21.0	24.4	4.6	2.9	25.8	3.2	2.0
6.2	4.72	22.4	23.7	5.2	2.9	25.3	3.7	2.0
7.1	4.87	22.7	23.3	5.7	2.8	25.1	3.9	1.9
8.1	5.26	23.1	22.0	6.6	2.8	23.9	4.7	2.0
9.2	5.28	22.3	21.1	7.5	2.8	23.2	5.4	2.0
11.1	5.10	20.4	20.0	8.6	2.7	22.6	6.0	1.9
0	2.54	20.5	40.4	.....	.....	40.4	.....	.....
1.6	2.59	20.2	39.0	1.4	2.1	39.6	.8	1.2
3.0	2.68	20.2	37.7	2.7	2.2	38.8	1.5	1.3
5.0	2.79	20.1	35.9	4.4	2.2	37.8	2.5	1.2
5.7	2.75	19.3	35.1	5.2	2.3	37.3	3·1	1.3
6.9	2.85	19.4	34.1	6.3	2.2	36.6	3.7	1.3
0	2.76	20.6	37.3	.....	.....	37.3	.....	.....
8.1	3.36	20.8	31.0	6.3	2.1	33.7	3.6	1.2
8.6	3.40	20.7	30.4	6.9	2.1	33.3	4.0	1.3
9.9	3.31	19.7	29.7	7.6	2.1	33.0	4.3	1.2
12.1	3.71	20.9	28.2	9.1	2.0	32.1	5.2	1.2
15.5	3.73	19.5	26.2	11.1	1.9	31.0	6.3	1.1
18.1	4.09	20.1	24.7	12.6	1.9	30.1	7.2	1.1

DURING last month the following dividends were disbursed in San Francisco, Cal., on the named gas shares:

Company.	Rate per Share.	Amount.
Capital Gas.....	$1.00.....	$10,000
Pacific Lighting....	.30.....	3,000
Oakland Gas.....	.20.....	6,000
Pac. Gas. Imp. Co..	.40.....	12,000
San Diego Gas.....	.25.....	1,250
San Francisco Gas..	.30.....	30,000
Stockton Gas.....	.25.....	1,250

In the meantime we might complete the list by stating that the California Electric Light Company also paid a dividend of 20 cents per share, amounting to $10,000.

ARTICLES incorporating the Texarkana (Ark.) Gas and Electric Light Company, filed on the 6th inst., show that the Company is capitalized in $200,000, and that its officers are: President, E. T Maxwell; Secretary, T. E. Walters.

AT the annual election of the New Albany (Ind.) Gas Light Company the following officers were chosen: Directors, W. S. Culbertson, Jno. McCulloch, J. K. Woodward, Sr., J. K. Woodward, Jr., and Geo. H. Davol; President, W. S. Culbertson; Vice-President, Geo. H. Davol; Secretary and Treasurer, J. K. Woodward, Jr. The improvements at this point are progressing satisfactorily.

MR. MADEIRA (vintage unknown) has presented the following bill to his confreres in the Missouri Legislature: Prohibiting cities and incorporated towns from granting charters to private corporations or individuals to construct surface or underground railroads, elevated roads, street railroads, gas, fuel, power, or electric light or water works. It provides that the municipal authorities of cities or incorporated towns are authorized to construct any or all of the above named improvements, if necessary, at public expense. The municipal authority of any city or incorporated town, which decides to construct any of the above named improvements, are authorized to issue bonds sufficient to cover the cost of construction and necessary equipments, and are empowered to secure such bonds by mortgage upon said improvements, the sale of such bonds to be advertised in at least one paper in this State, and one in New York city, and the bonds to be sold to the best bidder for the lowest rate of interest.

Spirally-Welded Steel Tubes.

At the session of the Franklin Institute (Phila., Pa.) held Jan. 16, Mr. J. C. Bayles spoke on the subject of "Spirally Welded Steel Tubes." Our abstract of his remarks is obtained from the *Journal* of the Institute. The speaker said:

The manufacture of light steel pressure pipes made from strips of metal wound laterally and hammer-welded, is an entirely new industry, employing means and producing results wholly unlike any before known in the arts.

In iron and steel pipe, it is desirable to use no more material than is needed to give the strength desired. This is true of all products, the progress of the arts tending steadily to a good constructive use of material, to secure a maximum of strength with a minimum of dead weight. As a rule, lap-welded tubes are enormously heavier than any thing in the service to which they are subjected warrants. They are made so for no other reason than that lighter stock than that employed in making them cannot be used. If the stock is heated in sheets, drawn from the furnaces at the welding temperature, shaped on a mandrel and welded, a considerable body of stock is needed to hold the heat during the shaping and welding processes. With thin sheets one of two things would happen—either the metal would chill instantly when drawn from the furnace and refuse to weld, or, if hot enough, would collapse upon itself, defeating all efforts to shape and weld it. Light pipes would have been made by lap-welding long ago had it been possible. As it is, they are much heavier than their strength calls for, the longitudinal weld being, as a rule, a line of weakness.

In spirally-welded pipes we have the material used to the very best advantage. The weld, instead of being a line of weakness, is a spiral reenforcement. A circumferential twisting strain is not created transversely to the weld, but longitudinally—or, to be more accurate, obliquely; and such pressure does not tend to open the seam, as in the case of a longitudinal weld, but to close it. The behavior of a spirally-welded pipe under pressure is illustrated by a very simple experiment. Roll a ribbon of paper into a spiral tube, as children make lamp lighters, pinch one end tightly shut and blow in the other. It will be found that the first effect of internal pressure is to tighten the seams, and the paper may be burst before any air will leak out between the edges of the parts in contact. I have seen a defective spirally-welded pipe leak under 20 pounds pressure, become tight at 50 pounds, and remain tight up to 350 pounds per square inch. Under an internal bursting strain the strength of a spirally-welded tube is found in the testing machine to be as great as the theoretical strength of the stock.

The process of manufacture is simple and inexpensive, but has entailed many and serious difficulties. These, however, have been overcome. Steel of suitable quality—that is, weldable and having a tensile strength of 65,000 pounds per square inch, with about 50 per cent. reduction of area, and 15 to 18 per cent. elongation, is rolled in grooves to the proper width and as long as may be convenient. These strips are welded end to end in a machine built for the purpose, which works very well. As they are welded into long bands, the strips are rolled on large reels which are passed to the pipe machines.

The essential features of the pipe machine are a guide-table for the skelp, adjustable to the desired angle; feed rolls to pass it forward with an intermittent progress, so that it shall advance when the former is raised, and be at rest when it falls; a former, to curve the metal to the desired radius, also adjustable; a furnace, to heat the metal; a hammer, to weld it, and an anvil to support the pipe and receive the shock of the hammer. No mandrel is used. The pipe in the forming process is held in place by a pipe mould, which is a cylindrical shell, within which the pipe rotates as the stock is fed in. The anvil is of considerable mass, steel-faced, and extends the entire width of the skelp. The hammer is light, and at normal speed strikes 350 blows per minute. The

heating is done in a furnace so constructed as to heat both the edges to be united for the space of several inches ahead of the point at which the welding is effected. The upper skelp enters the furnace flat, and the lower skelp curved, having already been through the forming jaws. The heat is imparted by one or two blow-pipes of water gas and air, discharging upon the metal through passages of suitable form in the refractory lining of the furnace. One gas flame has been found sufficient, but two work better; and besides being more convenient to control, they heat the metal more rapidly, and permit an accelerated feed. As very little gas is wasted, the greatest economy attends the most rapid production of pipe, irrespective of the quantity burned, which in any case is about 30 feet per foot of welded seam.

The speed of production depends, as stated, upon the thickness of stock to be heated, and the relation of width of skelp to diameter. It averages a foot per minute to each machine, and it is probable this average can be raised considerably. The machines are so nearly automatic in operation that very little skilled labor is needed in running the plant. The operator has his gas, air and feed under control by convenient means, and varies their relations until he has them just as he wants them. He can see the edges as they emerge from the furnace, and about all the skill he needs is that which will enable him to judge by its color whether the iron is above, below or at the welding-heat. Unskilled labor prepares the stock and removes the finished product. The ends of the pipe are cut square by suitable machinery without reversing, and after testing and treating with asphalt, the pipe is ready for shipment. As may be supposed, all the difficulties of mechanical development have centered in the pipe machine. To make this satisfactory in operation has probably been no more serious task than is usually entailed in the effort to make old mechanical motions perform new functions, but it has consumed a great deal of time and money.

The strengths attainable in light pipe, if the material is used to the best advantage, are quite surprising. A 6-inch pipe, made of No. 14 gauge iron of good average quality, showing under test 33,000 pounds elastic limit, and 50,000 pounds ultimate strength, has a proof strength of 913 pounds per square inch, and an ultimate strength of 1,383 pounds per square inch. A 12-inch pipe of the same stock has a proof strength of 456 pounds, and an ultimate strength of 691 pounds. If a good grade of soft steel is used instead of iron, the 6-inch pipe will carry 1,106 pounds pressure without deformation, and will not burst under 1,800 pounds; the 12-inch pipe can be tested to 475 pounds, and will carry 900 pounds without fracture. This is very practical pipe. Using the same diameters and gauges of stock for comparison, we find that the 6-inch spirally-welded pipe weighs 5·2 pounds per foot against 18·77 pounds per foot for standard lap-welded pipe, and 28·28 pounds for medium cast-iron pipe; the 12-inch spirally-welded pipe weighs 10·46 pounds against 54·65 pounds for lap-welded and 77·36 for medium cast-iron.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Mr. Egner Places His Evidence before the Jury—Our Readers.

ST. LOUIS, MO., Feb. 15, 1889.

To the Editor AMERICAN GAS LIGHT JOURNAL:

Mr. Henry C. Rew, of 2619 Prairie Avenue, Chicago, Ills., has seen fit to question the truth of statements made by me in the columns of your JOURNAL, and to generally attack my reputation. With your permission, and in order that the readers of the JOURNAL may not be left in any doubt as to the truth in the case, I will depart from a former resolve never to notice anything that Mr. Rew might say or write about me, as being not worth while, and submit the following statements, which I earnestly hope your readers will compare with Mr. Rew's communication, published in your paper of the 11th inst., and after that I will be content to let the question of my reputation rest with the intelligent reader and my friends of the gas profession everywhere.

On December 26, 1888, Mr. Rew wrote me as follows:

"My New York apparatus is completed, but will not be put in operation until the coal benches are shut down in the spring, owing to the difficulties foreseen in sending coal gas and water gas through the same apparatus. Yours truly,

"(Signed.) H. C. REW, 2619 Prairie Av."

Mr. Rew wrote to me, giving names which I do not wish to repeat, out of respect to the gentlemen mentioned, that a certain New York gas engineer had his apparatus in hand. If necessary I will give name and date, and if what I wrote in the article Mr. Rew complains about is untrue, I have only to say that he—Mr. Rew himself—was my informant, mainly, in regard to his patent apparatus, except as to the facts gleaned from the official Patent Office reports. Of course, I did not view his invention with the inventor's vision, but merely represented it as in my opinion it was. It may be the best apparatus ever invented, however, I do not think so. But Mr. Rew not only made to me the claims he *now* says are untrue, but he has also said similar things to others, *since* the date of published article. Now to Mr. Rew's "broad" claims about exhausting from a *water gas* apparatus—as distinguished from another kind of apparatus. That has been done at the works of the Peoples Gas Light and Coke Company, of Chicago, for over six years, with the Springer apparatus. And that is not the only item in which Rew imitates Springer, or others as well. Anyone who will take the trouble to write to Mr. Henry C. Pratt, whose advertisement appears elsewhere in this JOURNAL, can verify that statement, hence it need not rest upon the assertion of "the St. Louis oracle" at all.

I have recently seen a blue print of what may, perhaps, be Mr. Rew's completed apparatus, and is described by him as the "*greatest thing on earth, or a humbug. It is either the one or the other.*" So he writes, and I think he hit it correctly, too; for I must say that the figure in the blue print looks very different from the drawings of the patent specifications. Paraphrasing Mr. Rew's words, "his article illustrates how many blunders a man can make who 'rushes into print' in attempting to" (to which I add) blacken another man's reputation. Mr. Rew desired to edit whatever I would write about his apparatus, but as I declined, and gave my own, and not *his* view of it, he got angry. I am sorry that Mr. Rew has forced me to make the above statement, and I now will leave the subject with the jury of your readers. I could add more, but do not desire to interfere in Mr. Rew's future schemes. His "elected" will be capable of taking care of themselves, no doubt.

Very respectfully, FREDERIC EGNER.

The Gas Works' Coal Pile Does Not End in Ashes.

ST. LOUIS, MO., Feb. 8, 1889.

To the Editor AMERICAN GAS LIGHT JOURNAL:

Prof. Morton, in his lecture published in the JOURNAL of the 4th inst., states that: "Thus, starting with the coal pile and considering merely the question of the conversion of coal into light, one process is about as wasteful as the other at present." This implies that the cost of production is the same. He should have given the process of converting coal into gas a credit of at least 50 per cent. of the first cost of coal, on account of the residual products, coke, tar, and ammoniacal liquor.

The gas process is also entitled, in comparing its cost with incandescent electric lighting, to a further credit per each thousand cubic feet of an amount equal to one-third of the cost of each 16-candle power incandescent electric lamp, for the reason that in its lifetime of 600 hours one 16-candle power electric lamp gives a light equal only to 3,000 cubic feet of gas, burned through a 5-foot Sugg burner.

Suppose the first cost of lamp is 60 cents; the cost of replacing it after it has given out light equal to 3,000 cubic feet of gas would be equal to 20 cents per 1,000 cubic feet of gas.

The cost of renewing the electric lamp is as great as the cost of gas in the holder, in many of our large cities.

In the electric process, after using the coal pile you are encumbered with a heap of ashes. In gas making, your residuals are equal to from 50 to 75 per cent. of the value of the coal pile. Yours, etc.,

SYLVESTER WATTS.

SUPERINTENDENT LEARNED was a very much pleased individual, when, with tingling ears and sparkling eyes, listening to the encomiums passed on his management by the stockholders at the annual meeting of the Newton and Watertown (Mass.) Gas Light Company. They should have spoken pleasantly, too; for the annual sendout was reported at 47,000,000 cubic feet, or a trifle over 10 per cent. of an increase when compared with the output for '87. Thus encouraged, the Directors voted that a 200,000 cubic foot capacity holder be constructed, and that the Company's electric wires be extended so as to cover the public lighting districts in which oil lamps are now used. By the way, it is pleasant to note that the Newton authorities have ordered the continuance of the gas street lamps, the same to be equipped with 6-ft. burners. We would hear less about 2,000-candle power arcs for street lighting if the Newton gas lighting practice were tried a trifle oftener than it really is. The officers chosen were: Directors, Messrs. J. N. Bacon, Wm. Claflin, Geo. C. Lord, J. K. Stickney, C. C. Walworth, C. M. Seaver, H. L. Hovey, and A. Avery; Clerk and Treasurer, Francis Murdock.

THE electric light plant at Belvidere, N. J., has at last reached a safe haven. It is in the hands of the Sheriff of Warren county.

The Market for Gas Securities.

Consolidated is about same as last report, although the undertone during the interim of writing undoubtedly was weak. The appearance of an order for investment in the market would quite likely send these shares up to 85. Equitable is higher, at 113 bid, and it is extremely doubtful if much stock could be secured at the quoted bid price. These shares look cheap to us. Mutual shows no change. A rather startling thing to dealers was the appearance of an order for Northern shares, wherefore the brokers are predicting a general resurrection. Perhaps some of these once in-a-while overastute gentry would be more amazed were Northern to take unto itself a small sized boom. It is true that it could stand a raise. Brooklyn shares are about and about. Citizens has almost recovered the depression consequent upon the recent explosion, which leads us to the belief that the insurance companies either have or are about to settle.

That much-vaunted purchase with foreign capital by the Bay State syndicate of the old Boston Company appears to have gone the way of the average balloon, since we have positive information that the syndicate has notified the Boston Company that they (the syndicate) have failed to get the money. At any rate the former plan of purchase has been "scotched." One of the events of the week was the rise in Chicago Trusts, which are quoted to-day at 41½. In connection with this movement we are led to mquire where the Kiernan News Bureau derives its knowledge. A new staff of correspondents would seem to be in order for the safety of the veracity of that concern. Chicago gas bonds have also scored a material advance. Another outcropping for the week is to the effect that the United Gas Improvement Company has purchased a controlling interest in the McKay-Critchlow patents formerly owned by the American Gas Improvement Company. Why the latter should part with what is undoubtedly a valuable system is a trifle mysterious, unless (as was likely the case) the price paid for it was satisfactory to the seller.

We note that the New York Brush Company's branch has resumed the payment of dividends—2 per cent. quarterly. In the meantime, any one who wants to purchase 50 shares in the concern can have the same for 98, by applying to us. Not that we own it, nor do we propose to. Stock in the old Newark (N. J.) Company appears to have no limit as to value. Laclede, of St. Louis, can be purchased at 115. We also note that the city of Louisville (Ky.), in order to settle a debt of $28,500 that it owes to the Gas Company, proposes to sell bonds that it owns in the latter. These are gilt-edged.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

February 18.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	82	82¼
Central	466,000	50	—	—
" Scrip	220,000	—	47	57
Equitable	2,000,000	100	113	116
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	115	118
Mutual	3,500,000	100	98	100
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern	125,000	50	30	—
" Scrip	108,000			
Yonkers		50	90	100
Richmond Co., S. I.	300,000	50	55	60
" Bonds	12,000	—	—	—

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Four 8 x 10 ft. or 8 x 8 ft. Second-Hand Purifiers,

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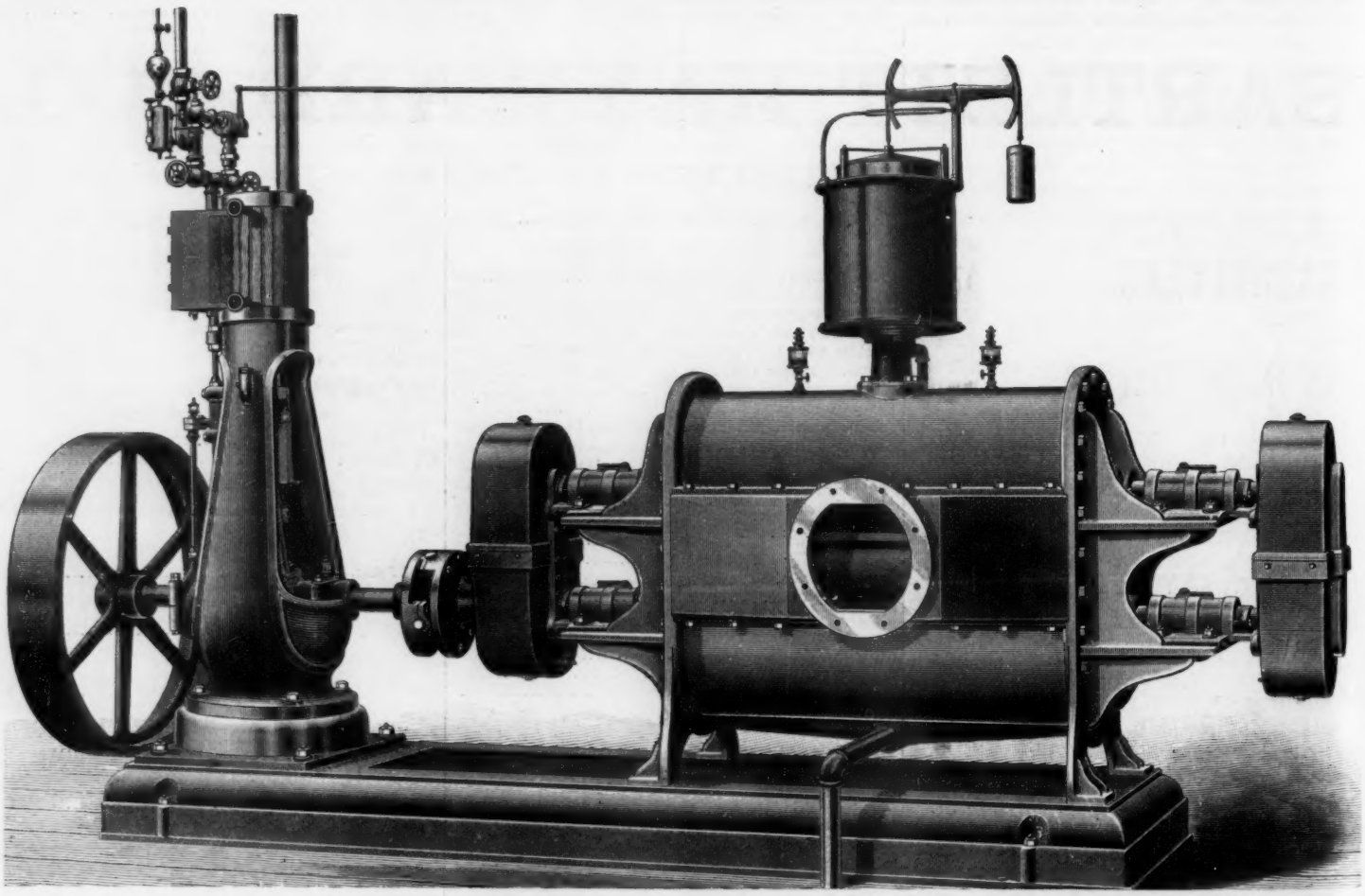

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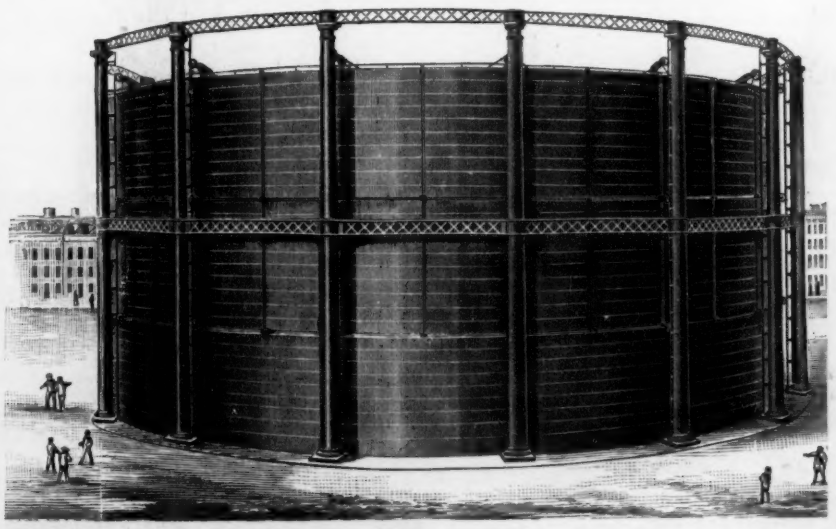

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A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, five years ago, in England, of the C. & W. Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. It is only necessary to give here a partial list in order to convince any intelligent American Gas Engineer that this machine must have succeeded fully in accomplishing the desired results.

The following Engineers have personally given permission to refer to them:

G. C. Trewby, Esq., Engineer-in-Chief of the Gas Light and Coke Co., London. The manufacturing plant at Beckton is built in complete sections of 3,000,000 cubic feet capacity each. A Walker Tar Extractor has been fitted to each one of these sections. This was done after a long and thorough trial on one of its sections. The Tar Extractor has been supplied to other works of the Gas Light and Coke Co., including those of which John Methven, Engineer of the Gas Light and Coke Co. at the Nine Elms Station, is in charge. Also to G. E. Stevenson, Peterborough Gas Works; B. Green, Mitcham and Wimbledon Gas Works; W. H. Smith, Bedford Gas Works; F. Linging, Norwich Gas Works; J. T. Browning, Colchester Gas Works; S. B. Darwin, Portsmouth Gas Works; J. McCrae, Dundee Gas Works; W. J. Wells, Stamford Gas Works; J. M. Darwin, Longton Gas Works; J. Paterson, Warrington Gas Works; and J. Coulter, of the Dundalk Gas Works. All of the foregoing gas works are located in Great Britain.

Mr. Charles A. Gerdenier, Superintendent of the Bridgeport (Conn.) Gas Light Company, writes as follows, under date of Dec. 3, 1887:

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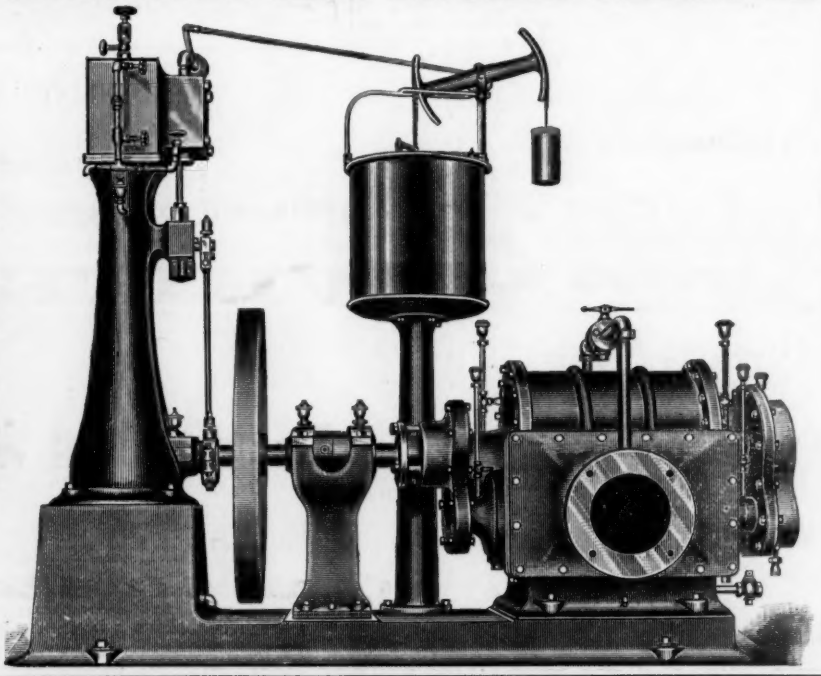

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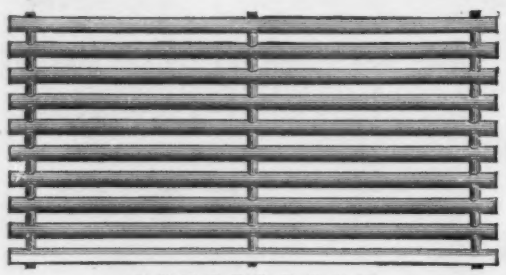

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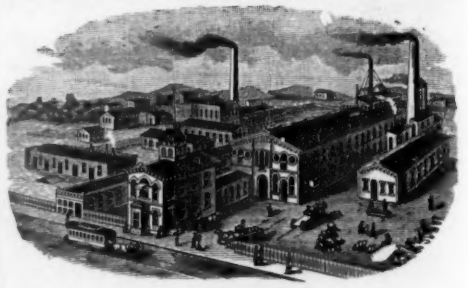

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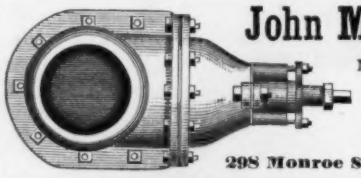

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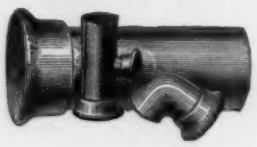

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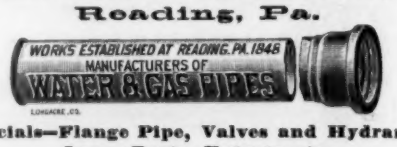

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Those who intend to make alterations in existing gas plants, or who contemplate the erection of new works, will find it to their interest to open correspondence with the above. Plans made and estimates furnished.

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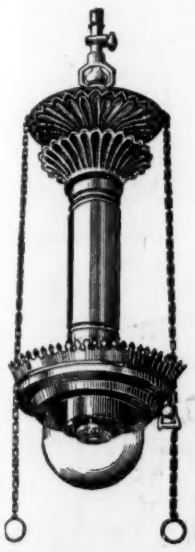

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Gas Companies contemplating the purchase of electric lighting plants, will do well to investigate the results that can be accomplished by a general introduction of the Lungren Regenerative Gas Lamp. In a number of instances Gas Companies have purchased these lamps and rented them to their consumers at a low rate, this plan proving satisfactory to the consumer, and profitable to the Gas Company. It requires but a small expenditure to establish a lighting system with the Lungren Lamp, which in its results will compare favorably with any system of electric lighting, both as to economy and effect. Numerous consumers have also been obtained by Gas Companies introducing these lamps, from among those using kerosene oil. Write us for particulars.

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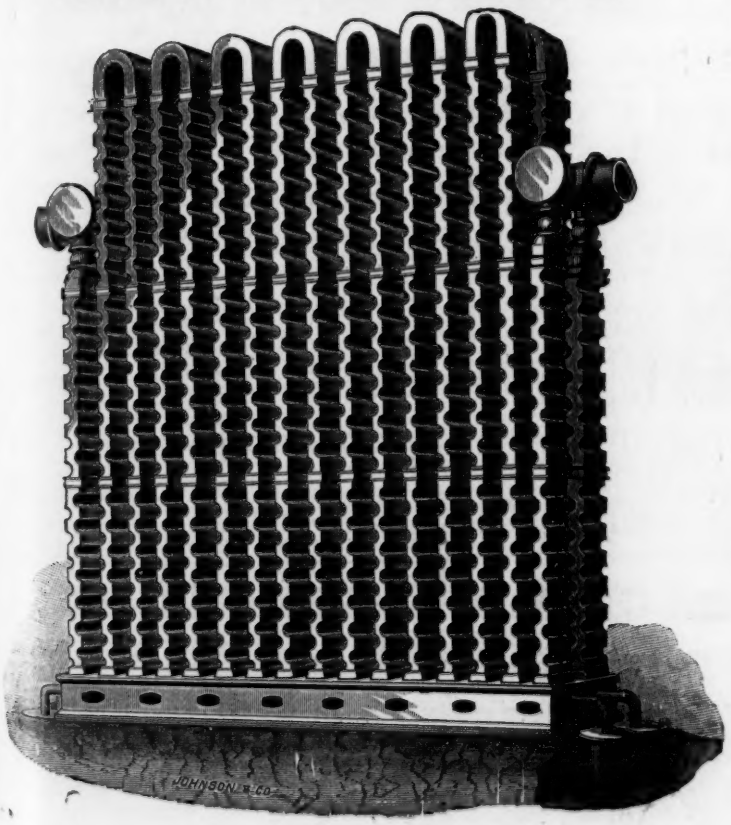

We desire to draw the attention of the gas community to the merits of the SINUOUS FRICTION CONDENSER. Companies intending to introduce new condensers into their works will do well to confer with us and examine plans and estimates before contracting for any other pattern The FRICTION CONDENSER is now in use at the gas works located in the following places:

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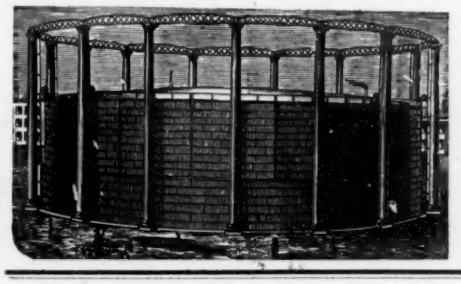

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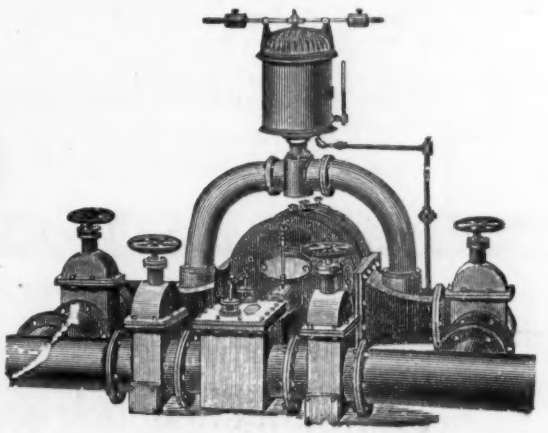

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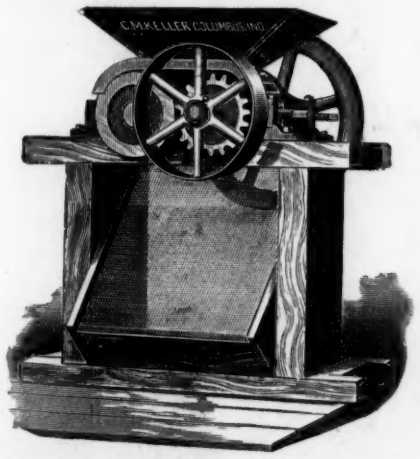

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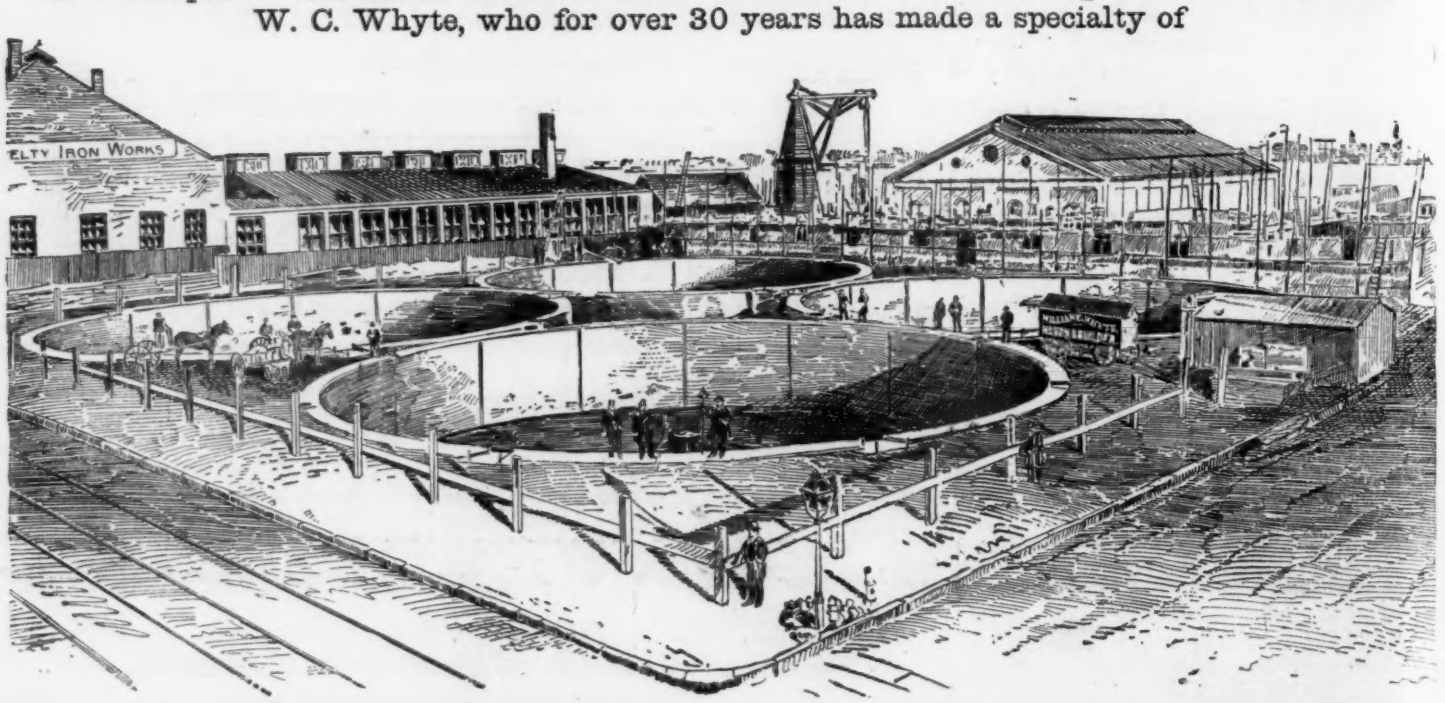

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"SUN DIAL" GAS STOVES,

The Most Economical, Efficient, and Durable Gas Stove Made.

GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.

"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

¾ in. supply pipe should be used where the pressure is 1 in. or over.